PHYSICS FORMULA SHEET

Grade 12 SPH4U

Fundamental Formulas

$\frac{-b\pm\sqrt{b^2-4ac}}{2a}$ $a^2 = b^2 + c^2 - 2(b)(c)cosA$ $\frac{a}{sinA} = \frac{b}{sinB} = \frac{c}{sinC}$

Kinematic Equations

$\Delta\vec{d} = \vec{v}_i\Delta t + \frac{1}{2}\vec{a}(\Delta t)^2$ $\vec{a}_g = 9.8\frac{m}{s^2}[down]$

$\Delta\vec{d} = \vec{v}_f\Delta t - \frac{1}{2}\vec{a}(\Delta t)^2$ $\vec{v}_{avg} = \frac{\Delta\vec{d}}{\Delta t} = \frac{\vec{d}_f - \vec{d}_i}{t_f - t_i}$

$\Delta\vec{d} = \frac{(\vec{v}_f + \vec{v}_i)}{2}\Delta t$ $\vec{a}_{avg} = \frac{\Delta\vec{v}}{\Delta t} = \frac{\vec{v}_f - \vec{v}_i}{t_f - t_i}$

$\vec{v}_f = \vec{v}_i + \vec{a}\Delta t$

$(\vec{v}_f)^2 = (\vec{v}_i)^2 + 2\vec{a}\Delta d$

Dynamics Formulas

$\vec{F}_g = m\vec{g}$ $\vec{F}_{net} = m\vec{a}$ $F_f = \mu_f F_N$

Uniform Circular Motion Equations

$\vec{a_c} = \frac{v^2}{r}$ $\vec{a_c} = 4\pi^2 r f^2$ $\vec{a_c} = \frac{4\pi^2 r}{T^2}$ $v = \frac{2\pi r}{T}$ $F_c = \frac{mv^2}{r}$ $\sum\vec{F} = m\vec{a_c}$

Work and Energy Formulas

$W = \vec{F}\Delta\vec{d}cos\theta$ $W = \Delta E$ $\Delta E_k = \frac{1}{2}mv^2$ $\vec{F}_x = k\Delta\vec{x}$ $T = 2\pi\sqrt{\frac{m}{k}}$

$\Delta E_g = mg\Delta h$ $E_e = \frac{1}{2}k\Delta x^2$ $P = \frac{W}{\Delta t}$

Collisions and Momentum Equations

$m_1\vec{v}_{i_1} + m_2\vec{v}_{i_2} = m_1\vec{v}_{f_1} + m_2\vec{v}_{f_2}$ $\frac{1}{2}m_1{\vec{v}_{i_1}}^2 + \frac{1}{2}m_2{\vec{v}_{i_2}}^2 = \frac{1}{2}m_1{\vec{v}_{f_1}}^2 + \frac{1}{2}m_2{\vec{v}_{f_2}}^2$

$\vec{p} = m\vec{v}$ $\Delta\vec{p} = \vec{F}\Delta t$ $\vec{v}_f = \frac{m_1\vec{v}_{i_1} + m_2\vec{v}_{i_2}}{m_1+m_2}$

$\vec{v}_{f_1} = \left(\frac{m_1-m_2}{m_1+m_2}\right)\vec{v}_{i_1} + \left(\frac{2m_2}{m_1+m_2}\right)\vec{v}_{i_2}$ $\vec{v}_{f_2} = \left(\frac{m_2-m_1}{m_1+m_2}\right)\vec{v}_{i_2} + \left(\frac{2m_1}{m_1+m_2}\right)\vec{v}_{i_1}$

$\vec{v}_{f_1} = \left(\frac{m_1-m_2}{m_1+m_2}\right)\vec{v}_{i_1}$ $\vec{v}_{f_2} = \left(\frac{2m_1}{m_1+m_2}\right)\vec{v}_{i_1}$

Gravitational, Electric, and Magnetic Fields Formulas

$m_{electron} = 9.11\times10^{-31}kg$ $m_{neutron} = 1.675\times10^{-27}kg$ $m_{proton} = 1.673\times10^{-27}kg$

$e = 1.602\times10^{-19}C$ $1\,eV = 1.602\times10^{-19}\,J$ $1C = 6.2\times10^{18}$ electrons

$F_g = \frac{Gm_1m_2}{r^2}$ $\vec{g} = \frac{Gm_p}{r^2}$ $v = \sqrt{\frac{Gm_p}{r}}$ $G = 6.67\times10^{-11}\frac{N\cdot m^2}{kg^2}$ $k = 8.99\times10^9\,\frac{N\cdot m^2}{C^2}$

$\vec{\varepsilon} = \frac{kq_2}{r^2}$ $F_E = \frac{kq_1q_2}{r^2}$ $\Delta V = \frac{\Delta E_E}{q}$ $\varepsilon = -\frac{\Delta V}{\Delta d}$

$V = \frac{E_E}{q}$ $\vec{F}_E = q\vec{\varepsilon}$ $E_E = \frac{kq_1q_2}{r}$ $\Delta E_E = E_{Ef} - E_{Ei}$

$V = \frac{kq}{r}$ $\Delta E_E = -q\varepsilon\Delta d$ $\Delta E_E = \frac{kq_1q_2}{r_f} - \frac{kq_1q_2}{r_i}$

$F_M = qvB\sin\theta$

$F_M = ILB\sin\theta$ $V = \frac{kq\Delta d}{r^2}$ $I = \frac{q\cdot N}{\Delta t}$ $q = Ne$

Waves and Light Formulas

$v = f\lambda$ $f = \frac{1}{T}$ $n_1\sin\theta_1 = n_2\sin\theta_2$ $n = \frac{\lambda_1}{\lambda_2}$ $\frac{n_2}{n_1} = \frac{\lambda_1}{\lambda_2}$

$|P_nS_1 - P_nS_2| = \left(n-\frac{1}{2}\right)\lambda$ $\sin\theta_n = \frac{\left(n-\frac{1}{2}\right)\lambda}{d}$ $sin\theta_c = \frac{n_2}{n_1}$

$\sin\theta_m = \frac{m\lambda}{d}$ $\sin\theta_n = \frac{\left(n-\frac{1}{2}\right)\lambda}{d}$

$x_m = \frac{mL\lambda}{d}$ $x_n = \frac{\left(n-\frac{1}{2}\right)L\lambda}{d}$ $\Delta x = \frac{L\lambda}{d}$ $\frac{x_n}{L} = \frac{\left(n-\frac{1}{2}\right)\lambda}{d}$

$2t = \frac{\left(m+\frac{1}{2}\right)\lambda}{n_{film}}$ $2t = \frac{n\lambda}{n_{film}}$ $\Delta x = L\left(\frac{\lambda}{2t}\right)$ $\sin\theta_n = \frac{x_n}{L}$

$\sin\theta_m = \frac{\left(m+\frac{1}{2}\right)\lambda}{w}$ $\sin\theta_n = \frac{n\lambda}{w}$ $d = \frac{1}{N}$

$y_m = \frac{\left(m+\frac{1}{2}\right)L\lambda}{w}$ $y_n = \frac{nL\lambda}{w}$ $\Delta y = \frac{L\lambda}{w}$

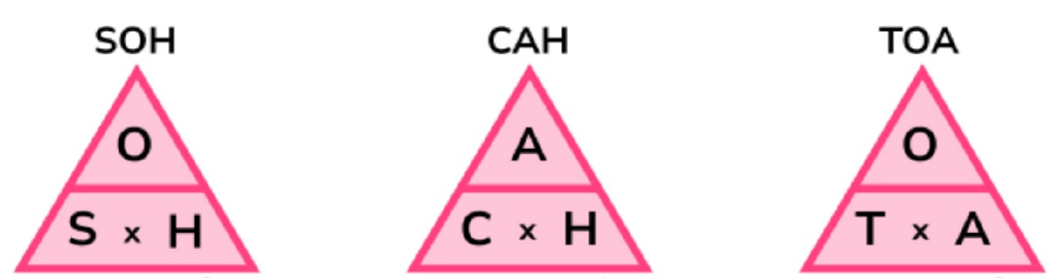
Quantum Mechanics and Special Relativity

$\Delta t_m = \frac{\Delta t_s}{\sqrt{1-\frac{v^2}{c^2}}}$ $L_m = L_s\sqrt{1-\frac{v^2}{c^2}}$ $p = \frac{mv}{\sqrt{1-\frac{v^2}{c^2}}}$ $m_m = \frac{m_s}{\sqrt{1-\frac{v^2}{c^2}}}$

$E_{total} = \frac{mc^2}{\sqrt{1-\frac{v^2}{c^2}}}$ $E_{rest} = mc^2$ $E_{total} = E_K + E_{rest}$

$W = e\Delta V$ $E_{photon} = hf = \frac{hc}{\lambda}$ $E_k = hf - hf_0$ $E_k = hf - W$

$p_{photon} = \frac{hf}{c} = \frac{h}{\lambda}$ $1eV = 1.602\times10^{-19}J$ $h = 6.63\times10^{-34}\,J\cdot s$



$\sin(\theta) = \frac{O}{H}$ $\cos(\theta) = \frac{A}{H}$ $\tan(\theta) = \frac{O}{A}$