Equations/Constants

$\Delta\vec{d} = \vec{d}_{final} - \vec{d}_{initial}$ $\Delta\vec{d}_{total} = \Delta\vec{d_1} + \Delta\vec{d_2} + \cdots$ $\vec{v} = \frac{\Delta\vec{d}}{\Delta t} = \frac{\vec{d_2} - \vec{d_1}}{\Delta t}$

$\vec{a} = \frac{\Delta\vec{v}}{\Delta t} = \frac{\vec{v_2} - \vec{v_1}}{\Delta t}$ $\Delta\vec{d} = (\frac{\vec{v_1} + \vec{v_2}}{2})\Delta t$ $\vec{v_2^2} = \vec{v_1^2} + 2\vec{a}\Delta\vec{d}$

$\Delta\vec{d} = \vec{v_1}\Delta t + \frac{1}{2}\vec{a}\Delta t^2$ $\Delta\vec{d} = \vec{v_2}\Delta t - \frac{1}{2}\vec{a}\Delta t^2$ $\vec{v_2} = \vec{v_1} + \vec{a}\Delta t$

$R = \frac{v_i^2 \sin 2\theta}{g}$ $ToF = \frac{2v_i \sin\theta}{g}$ $H = \frac{v_i^2 \sin^2\theta}{2g}$

$\vec{F_{Net}} = m\vec{a} = \vec{F_1} + \vec{F_2} + \vec{F_3} + \cdots$ $\mu = \frac{F_f}{F_N}$ $a_c = \frac{v^2}{r} = \frac{4\pi^2 r}{T^2} = 4\pi^2 r f^2$ $F_c = ma_c = \frac{mv^2}{r}$

$F_G = \frac{Gm_1m_2}{r^2}$

Translation	Rotation	Connection
x	θ	$\boldsymbol{x = \theta r}$
v	ω	$\boldsymbol{v = r\omega}$ $\boldsymbol{\bar{\omega} = \frac{\Delta\theta}{\Delta t} = \frac{\theta_f - \theta_i}{t_f - t_i}}$
a	α	$\boldsymbol{a_{tan} = \frac{\Delta v}{\Delta t} = r\frac{\Delta\omega}{\Delta t} = r\alpha}$ $\boldsymbol{\bar{\alpha} = \frac{\omega_2 - \omega_1}{\Delta t} = \frac{\Delta\omega}{\Delta t}}$
m	I	$\boldsymbol{I = \sum_i m_i r_i^2}$
F	τ	$\boldsymbol{\tau \equiv rF\sin\emptyset = Fd}$
Ek	$\boldsymbol{E_k = \frac{1}{2}\sum_i(m_i r_i^2)\,\omega^2 = \frac{1}{2}I\omega^2}$	
p= mv	$\boldsymbol{L = I\omega}$	
W = Fd	$\boldsymbol{W = Fr\Delta\theta = \tau\Delta\theta}$	
$\boldsymbol{\sum F = ma}$	$\boldsymbol{\sum \tau = I\alpha}$	
$\boldsymbol{\sum F = \frac{\Delta p}{\Delta t}}$	$\boldsymbol{\sum \tau = \frac{\Delta L}{\Delta t}}$	
$\boldsymbol{P = \frac{\Delta E}{\Delta t} = \frac{W}{\Delta t}}$	$\boldsymbol{P = \frac{\tau\Delta\theta}{\Delta t} = \tau\omega}$	

$\boldsymbol{\vec{a} = \vec{a}_{tan} + \vec{a}_R}$ $\boldsymbol{a_R = \frac{v^2}{r} = \omega^2 r}$

$W = F\Delta d$ $W_{Net} = F_{Net}\Delta d$ $W = F(\cos\theta)\Delta d$

$P = \frac{W_{Net}}{\Delta t} = \frac{\Delta E}{\Delta t}$ $E_k = \frac{1}{2}mv^2$ $E_g = mgh$ $E_e = \frac{1}{2}k(\Delta x)^2$

$\vec{F_x} = k\Delta\vec{x}$ $T = 2\pi\sqrt{\frac{m}{k}}$ $\vec{p} = m\vec{v}$ $\vec{F}\Delta t = \Delta\vec{p}$

$\vec{v_{f1}} = \left(\frac{m_1 - m_2}{m_1 + m_2}\right)\vec{v_{i1}} + \left(\frac{2m_2}{m_1 + m_2}\right)\vec{v_{i2}}$ $\vec{v_{f2}} = \left(\frac{2m_1}{m_1 + m_2}\right)\vec{v_{i1}} + \left(\frac{m_2 - m_1}{m_1 + m_2}\right)\vec{v_{i2}}$

$F_E = k\frac{q_1q_2}{r^2}$ $\vec{F_e} = q\vec{\varepsilon}$ $\varepsilon = \frac{kq_2}{r^2}$

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

$E_E = \frac{kq_1q_2}{r}$ $W = -\Delta E_E$ $W = F_E\Delta d$

$F_m = qvB\sin\theta$ $F_{onwire} = ILB\sin\theta$ $r = \frac{mv}{qB}$

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

$d\sin\theta = n\lambda$ $d\sin\theta = \left(m + \frac{1}{2}\right)\lambda$ $x_m = \frac{mL\lambda}{d}$ $x_n = \left(n - \frac{1}{2}\right)\frac{L\lambda}{d}$

$2t = \frac{\left(m + \frac{1}{2}\right)\lambda}{n_{film}}$ $2t = \frac{n\lambda}{n_{film}}$ $\tan\theta_B = \frac{n_2}{n_1}$ $I_{out} = I_{in}\cos^2\theta$

Constants	Approximate Value
Acceleration due to Gravity (g)	9.8 m/s^2
Gravitational constant (G)	6.67 x 10^{-11} Nm^2/kg^2
Speed of Light in Vacuum (c)	3.0x10^8 m/s
Coulomb's Constant (k)	8.99x10^9 Nm^2/C^2
Charge on electron (q)	- 1.60x10^{-19} C
Charge on proton (q)	+1.60x10^{-19} C
Electron volt	1.6x10^{-19} J
Mass of electron (m_e)	9.11 x 10^{-31} kg
Mass of proton (m_p)	1.67 x 10-^{27} kg