Physics 102–Our Basic Equations

$r_x = r\cos\theta \quad r_y = r\sin\theta \quad r = \sqrt{r_x^2 + r_y^2} \quad \theta_{CALC} = \arctan\frac{r_y}{r_x} \quad \theta_{REAL} = \theta_{CALC}\ in\ 1\ \&\ 4 \quad \theta_{REAL} = \theta_{CALC} + 180°\ in\ 2\ \&\ 3$

$v_f = v_i + a\Delta t \quad x_f = x_i + v_i\Delta t + \tfrac{1}{2}a_x(\Delta t)^2 \quad v_f^2 = v_i^2 + 2a\Delta s \quad s_f = s_i + \tfrac{1}{2}(v_i + v_f)\Delta t \quad \theta = \frac{s}{r} \quad \omega = \frac{v_{\text{tang}}}{r} \quad \Sigma\vec{F} = m\vec{a}$

$\Sigma\vec{F} = m\vec{a} \quad F_g = w = mg \quad W = \vec{F}\bullet\Delta\vec{r} = F\Delta r\cos\theta \quad KE \equiv \tfrac{1}{2}mv^2 \quad \vec{p} \equiv m\vec{v} \quad W_{net} = \Delta KE = \tfrac{1}{2}mv_f^2 - \tfrac{1}{2}mv_i^2$

$P_{av} \equiv \frac{W}{\Delta t} = \vec{F}\bullet\vec{v} \quad a_c = \frac{v^2}{r} = r\omega^2 \quad F_g = G\frac{m_1 m_2}{r^2} \quad x = A\cos(\omega t + \phi) \quad \omega = \sqrt{\frac{k}{m}} = 2\pi f = \frac{2\pi}{T} \quad y = A\sin\left[\frac{2\pi}{\lambda}(x - vt)\right]$

$v = \frac{\lambda}{T} = f\lambda \quad k \equiv \frac{2\pi}{\lambda} \quad \omega \equiv \frac{2\pi}{T} = 2\pi f \quad f' = f\left(\frac{v + v_O}{v - v_S}\right)$ The equations from Phys 102 start below.

$\vec{F} = k_e\frac{|q_1||q_2|}{r^2} \quad \vec{E} \equiv \frac{\vec{F}_e}{q_0} = k_e\frac{|q|}{r^2} \quad W = qE_x\Delta x = \Delta KE = -\Delta PE \quad \Delta V = -E_x\Delta x \quad \Delta V = k_e\frac{q}{r} \quad PE = q_2V_1 = k_e\frac{q_1q_2}{r} \quad W = -q(V_B - V_A)$

$C \equiv \frac{Q}{\Delta V} \quad C = \varepsilon_0\frac{A}{d} \quad C_p = C_1 + C_2 + \ldots \quad \frac{1}{C_s} = \frac{1}{C_1} + \frac{1}{C_2} + \ldots \quad C = \kappa C_0 = \kappa\frac{\varepsilon_0 A}{d} \quad PE_C = \tfrac{1}{2}Q\Delta V = \tfrac{1}{2}C(\Delta V)^2 = \frac{Q^2}{2C} \quad C = \kappa\varepsilon_0\frac{A}{d}$

$I \equiv \frac{\Delta Q}{\Delta t} \quad \Delta V = IR \quad R = \rho\frac{l}{A} \quad \rho = \rho_0\left[1 + \alpha(T - T_0)\right] \quad R = R_0\left[1 + \alpha(T - T_0)\right] \quad P = I\Delta V \quad P = I^2R = \frac{\Delta V^2}{R} \quad \Delta V = \mathcal{E} - Ir$

$\mathcal{E} = IR + Ir \quad R_S = R_1 + R_2 + \ldots \quad \frac{1}{R_P} = \frac{1}{R_1} + \frac{1}{R_2} + \ldots \quad q = Q\left(1 - e^{-t/\tau}\right) \quad \tau = RC \quad F = qvB\sin\theta \quad r = \frac{mv}{qB} \quad F = BI\ell\sin\theta$

$\tau = BIAN\sin\theta \quad \frac{F}{\ell} = \frac{\mu_0 I_1 I_2}{2\pi d} \quad B = \mu_0 nI \quad n = N/\ell \quad \Phi_B = BA\cos\theta \quad \mathcal{E} = -N\frac{\Delta\Phi_B}{\Delta t} \quad |\mathcal{E}| = B\ell v \quad \mathcal{E} = NBA\omega\sin\omega t$

$\Delta V = \Delta V_{\max}\sin\omega t \quad \omega = 2\pi f \quad \Delta V_{rms} = 0.7071\ \Delta V_{\max} \quad \Delta V_2 = \frac{N_2}{N_1}\Delta V_1 \quad I_1\Delta V_1 = I_2\Delta V_2 \quad c = f\lambda \quad f_o \approx f_s\left(1 \pm \frac{u}{c}\right) \quad \theta_r = \theta_i$

$n \equiv \frac{c}{v} \quad n_1\sin\theta_1 = n_2\sin\theta_2 \quad \sin\theta_c = \frac{n_2}{n_1} \quad o = p, i = q \quad \frac{1}{o} + \frac{1}{i} = \frac{1}{f} \quad f = \frac{R}{2} \quad M = \frac{h'}{h} = \frac{i}{o} \quad d\sin\theta_{brt} = m\lambda \quad m = 0, \pm1, \pm2,..$

$d\sin\theta_{drk} = \left(m + \tfrac{1}{2}\right)\lambda \ \ m = 0, \pm1, \pm2,.. \quad \sin\theta = \frac{y}{L}\ if\ \theta \ll 1 \quad \lambda_n = \frac{\lambda}{n} \quad 2nt = \left(m + \tfrac{1}{2}\right)\lambda \quad 2nt = m\lambda \quad \sin\theta_{drk} = \frac{m\lambda}{a} \ \ m = \pm1, \pm2,..$

Coulomb constant	k_e	8.988 x 10^9 N•m^2/C^2	Acc. of gravity	g	9.807 m/s^2
electron charge	e	1.602 x 10^{-19} C	Planck's constant	h	6.626 x 10^{-34} J•s
permittivity of vac	ε_0	8.854 x 10^{-12} F/m	Avogadro's number	N_A	6.022 x 10^{23} /mol
permeability of vac	μ_0	4π x 10^{-7} N/A^2	Boltzman constant	k	1.381 x 10^{-23} J/K
mass of electron	m_e	9.109 x 10^{-31} kg	Stephan-Boltzman	σ	5.671 x 10^{-8} W/(m^{-2}•K^{-4})
mass of proton	m_p	1.673 x 10^{-27} kg	Rydberg constant	R_∞	1.097 x 10^7 /m
mass of neutron	m_n	1.675 x 10^{-27} kg	Wein's constant	b	2.898 x 10^{-3} m•K
speed of light	c	2.998 x 10^8 m/s	Std. atmosphere		1.013 x 10^5 Pa