

Physics 102-Our Basic Equations

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

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

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

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

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

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

$$C \equiv \frac{Q}{\Delta V} \quad C = \epsilon_0 \frac{A}{d} \quad C_p = C_1 + C_2 + \dots \quad \frac{1}{C_s} = \frac{1}{C_1} + \frac{1}{C_2} + \dots \quad C = \kappa C_0 = \kappa \frac{\epsilon_0 A}{d} \quad PE_C = \frac{1}{2}Q\Delta V = \frac{1}{2}C(\Delta V)^2 = \frac{Q^2}{2C} \quad C = \kappa\epsilon_0 \frac{A}{d}$$

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

$$\mathcal{E} = IR + Ir \quad R_s = R_1 + R_2 + \dots \quad \frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \dots \quad q = Q(1 - e^{-t/\tau}) \quad \tau = RC$$

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