

$$\vec{F} = m \vec{a} \quad \vec{p} = m \vec{v} \quad KE = \frac{1}{2} m v^2 = \frac{p^2}{2m} \quad W_{\text{tot}} = \Delta(KE) = KE_f - KE_i$$

$$m \mathbf{a}_{\text{ucm}} = \frac{m \mathbf{v}^2}{R}$$

$$k = 8.99 (10)^9 \left[\frac{\text{Nm}^2}{\text{C}^2} \right]$$

$$k = \frac{1}{4\pi \epsilon_0}$$

$$A_{\text{sphere-surface}} = 4\pi r^2$$

$$F = k \frac{q_1 q_2}{r^2} = \frac{1}{4\pi \epsilon_0} \frac{q_1 q_2}{r^2}$$

$$\epsilon_0 = 8.85 (10)^{-12} \left[\frac{\text{C}^2}{\text{Nm}^2} \right]$$

$$\mu_0 = 4\pi (10)^{-7} \text{Tm/A}$$

$$A_{\text{circle}} = \pi r^2$$

$$V_{\text{sphere}} = \frac{4}{3} \pi r^3$$

$$E = \frac{F}{q} \quad V = \frac{U}{q}$$

$$E = k \frac{q}{r^2} = \frac{1}{4\pi \epsilon_0} \frac{q}{r^2} \quad V = k \frac{q}{r} = \frac{1}{4\pi \epsilon_0} \frac{q}{r}$$

$$\sim e^{-t/\tau}$$

$$\sum_{\text{surf}} \mathbf{E}_{\perp} \Delta A = \frac{q_{\text{inside}}}{\epsilon_0}$$

$$Q = VC \quad C = \frac{A\epsilon_0}{d} \quad \sigma = \frac{Q}{A} \quad \frac{QV}{2} = \frac{CV^2}{2} = \frac{Q^2}{2C}$$

$$\frac{QV}{2} = \frac{CV^2}{2} = \frac{Q^2}{2C}$$

$$\tau = RC$$

$$\tau = L/R$$

$$V = Ed \quad E = \frac{\sigma}{\epsilon_0}$$

$$\frac{1}{C_{\text{eff}}} = \frac{1}{C_1} + \frac{1}{C_2}$$

$$C_{\text{eff}} = C_1 + C_2$$

$$\sum_{\text{junc}} I_j = 0$$

$$V = IR$$

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

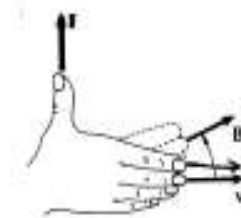
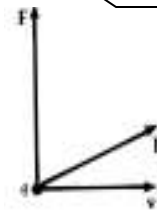
$$R_{\text{eff}} = R_1 + R_2$$

$$\frac{1}{R_{\text{eff}}} = \frac{1}{R_1} + \frac{1}{R_2}$$

$$\sum_{\text{loop}} V_j = 0$$

$$F = q v B_{\perp} = q v_{\perp} B = q v B \sin(\theta)$$

$$F = IL B_{\perp} = I_{\perp} L B = IL B \sin(\theta)$$



$$B = \frac{\mu_0 I}{2\pi r}$$



$$\mu_0 = 4\pi (10)^{-7} \text{Tm/A}$$

$$\sum_{\text{curv}} B_{\parallel} \Delta l = \mu_0 I_{\perp}$$

$$\Phi = \sum B_{\perp} \Delta A \quad \left| \begin{array}{l} E = mc^2 \quad m = m_0 / \sqrt{1 - (v/c)^2} \\ E = -13.6 \frac{(Z^*)^2}{n^2} \text{ (eV)} \end{array} \right. \quad \frac{A}{Z} X$$

$$\mathcal{E} = -N \frac{\Delta\Phi}{\Delta t} \quad \left| \begin{array}{l} \tau = \tau_0 / \sqrt{1 - v^2/c^2} \\ r = .53 \frac{n^2}{Z} \text{ (\AA)} \end{array} \right. \quad \begin{array}{l} {}^1_1\text{p} \quad {}^1_0\text{n} \quad {}^4_2\text{He} \quad e^- \quad e^+ \\ 938 \text{ MeV} \quad .511 \text{ MeV} \end{array}$$

$$\mathcal{E} = -L \frac{\Delta I}{\Delta t} \quad \left| \begin{array}{l} L = L_0 \sqrt{1 - v^2/c^2} \\ E = \frac{p^2}{2m} + V(x) \end{array} \right. \quad \begin{array}{l} |\psi(x)|^2 \\ N = N_0 \left(\frac{1}{2}\right)^{t/T_{1/2}} \end{array}$$

$$\omega_0 = 1/\sqrt{LC} \quad \left| \begin{array}{l} E = hf \\ hf = \phi_0 + \frac{1}{2}mv^2 \\ h = 6.63(10)^{-34} \text{ Js} \end{array} \right. \quad \begin{array}{l} L = n \frac{\lambda}{2} \\ \Delta p \Delta x \geq h/2\pi \\ \Delta E \Delta t \geq h/2\pi \end{array}$$

$$V = IZ \quad \left| \begin{array}{l} Z_C = X_C = 1/\omega C \\ Z_L = X_L = \omega L \\ Z = \sqrt{R^2 + (X_L - X_C)^2} \end{array} \right. \quad \begin{array}{l} n = 1, 2, 3, \dots \\ l = 0, 1, 2, \dots \\ l = n - 1, n - 2, \dots \\ m = -l, -l + 1, \dots, l - 1, l \end{array}$$

$$c = \lambda f \quad \frac{\Delta f}{f} = \pm \frac{v}{c} \quad \left| \begin{array}{l} \frac{d}{2} \sin(\theta) = \dots \\ d \sin(\theta) = \dots \end{array} \right. \quad \begin{array}{l} 2l + 1 \\ \frac{1}{f} = \frac{1}{o} + \frac{1}{i} \end{array}$$

$$c = 3 \times 10^8 \text{ m/s} = \frac{1}{\sqrt{\epsilon_0 \mu_0}} \quad \left| \begin{array}{l} u = \frac{1}{2} \epsilon_0 E^2 + \frac{1}{2 \mu_0} B^2 \\ \theta_i = \theta_r \quad n = \frac{c}{v} \quad m = -\frac{i}{o} \end{array} \right. \quad \begin{array}{l} \end{array}$$

$$u = \frac{1}{2} \epsilon_0 E^2 + \frac{1}{2 \mu_0} B^2 \quad \left| \begin{array}{l} \theta_i = \theta_r \quad n = \frac{c}{v} \quad m = -\frac{i}{o} \\ n_1 \sin(\theta_1) = n_2 \sin(\theta_2) \end{array} \right. \quad \begin{array}{l} \end{array}$$

$$\theta_i = \theta_r \quad n = \frac{c}{v} \quad m = -\frac{i}{o} \quad \left| \begin{array}{l} \frac{1}{f} = \frac{1}{o} + \frac{1}{i} \end{array} \right. \quad \begin{array}{l} \end{array}$$

$$n_1 \sin(\theta_1) = n_2 \sin(\theta_2) \quad \left| \begin{array}{l} \frac{1}{f} = \frac{1}{o} + \frac{1}{i} \end{array} \right. \quad \begin{array}{l} \end{array}$$

$$\frac{1}{f} = \frac{1}{o} + \frac{1}{i}$$