

$$\vec{F} = k q_1 q_2 \frac{\hat{r}_{12}}{r_{12}^2} = \frac{1}{4\pi\epsilon_0} \frac{q_1 q_2}{r_{12}^2} \hat{r}_{12} \quad \left\{ \begin{array}{l} Q = CE(1 - e^{-t/RC}) \\ Q = Q_0 e^{-t/RC} \end{array} \right.$$

$$\phi_E = \oint \vec{E} \cdot d\vec{A}$$

$$\oint \vec{E} \cdot d\vec{A} = \frac{Q_{encl}}{\epsilon_0}$$

$$E_S = -dV/ds$$

$$v = w/q$$

$$V_{pt\ chg} = \frac{kq}{R}$$

$$\vec{E} = \int_{vol} k \frac{dQ}{r^2} dr \hat{r}$$

$$V = \int_{vol} \frac{k dQ}{r}$$

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

$$V = IR$$

$$E = E_0/\kappa$$

$$C = \kappa C_0$$

$$U_{cap} = \frac{1}{2} CV^2$$

$$Q = CV$$

$$C = \sum C_i \text{ Parallel}$$

$$\frac{1}{C} = \sum \frac{1}{C_i} \text{ Series}$$

$$R = \sum R_i \text{ Series}$$

$$\frac{1}{R} = \sum \frac{1}{R_i} \text{ Parallel}$$

$$\vec{F} = q \vec{v} \times \vec{B} = i \vec{L} \times \vec{B}$$

$$\vec{\mu} = ni \vec{A}$$

$$\vec{L} = \vec{\mu} \times \vec{B}$$

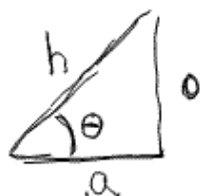
$$B_{solenoid} = \mu_0 n I$$

$$d\vec{B} = \frac{\mu_0}{4\pi} \frac{id\vec{l} \times \hat{r}}{r^2}$$

$$\oint_c \vec{B} \cdot d\vec{l} = \mu_0 I_{encl}$$

$$\text{Sphere: } \begin{array}{l} A = 4\pi r^2 \\ V = \frac{4}{3}\pi r^3 \end{array}$$

$$\text{Cylinder: } \begin{array}{l} A = 2\pi rL + 2\pi r^2 \\ V = \pi r^2 L \end{array}$$



$$\sin \theta = \frac{h}{h}$$

$$\cos \theta = \frac{a}{h}$$

$$\tan \theta = \frac{h}{a}$$

$$\text{Const. Accel. } \left\{ \begin{array}{l} v = v_0 + at \\ x = x_0 + v_0 t + \frac{1}{2} at^2 \\ v^2 = v_0^2 + 2a(x - x_0) \\ x^2 = x_0 + \frac{1}{2}(v_0 + v)t \end{array} \right.$$

$$a_c = \frac{mv^2}{R}$$

$$S = R\theta$$

$$KE = \frac{1}{2} m v^2$$

$$PE_{spring} = \frac{1}{2} k x^2$$

$$\vec{L} = \vec{r} \times \vec{p}$$

$$\vec{L} = \vec{r} \times \vec{F}$$

$$\int u^n du = \frac{u^{n+1}}{n+1}$$

$$\int \frac{du}{u} = \ln|u|$$

$$\int e^u du = e^u$$

$$\int \frac{x dx}{\sqrt{x^2 + a^2}} = \sqrt{x^2 + a^2}$$

$$\mathcal{E} = - \frac{d\Phi_B}{dt}$$

$$\Phi_B = \int \vec{B} \cdot d\vec{A}$$

$$\mathcal{E}_1 = -L \frac{di_2}{dt}$$

$$\Phi_1 = Li_2$$

$$\mathcal{E}_1 = -M \frac{di_1}{dt}$$

$$\Phi_1 = Mi_1$$

$$U_m = \frac{B^2}{2\mu_0}$$

$$v = \lambda \nu$$

$$n_1 \sin \theta_1 = n_2 \sin \theta_2$$

$$n = c/v$$

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

$$m = -\frac{i}{o}$$

$$d \sin \theta = m \lambda$$

$$\theta \sim 1.22 \lambda/D$$

$$E = h\nu$$

$$\lambda = h/p$$

$$E_n = -\frac{Z^2}{n^2} |E_1|$$

$$E_1 = -13.6 \text{ eV}$$

$$E_n = -\frac{mk^2 Z^2 e^4}{2n^2 h^2}$$

$$r_n = \frac{n^2 h^2}{k Z e^2 m}$$

$$r_n = \frac{n^2}{Z} r_1$$

$$a(t) = a(0) e^{-\lambda t}$$

$$t_{1/2} = \frac{0.693}{\lambda}$$

$$N(t) = N(0) e^{-\lambda t}$$