$$x = x_0 + v_0 t + \frac{1}{2} a t^2$$

$$v = v_0 + at$$

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

$$F = ma$$

$$F = \frac{k q_1 q_2}{r^2}$$

$$k = \frac{1}{4\pi\varepsilon_0}$$

$$E = \frac{F}{q_0}$$

$$E = \frac{kq}{r^2}$$

$$E = \frac{q}{\varepsilon_0 A} = \frac{\sigma}{\varepsilon_0}$$

$$W_{AB} = EPE_A - EPE_B$$

$$V = \frac{EPE}{q_0}$$

$$V_B - V_A = \frac{-W_{AB}}{q_0}$$

$$V = \frac{kq}{r}$$

$$q = CV$$

$$\kappa = \frac{E_0}{E}$$

$$E = \frac{V}{d}$$

$$C = \frac{\kappa\varepsilon_0 A}{d}$$

$$\text{Energy} = \frac{1}{2} qV = \frac{1}{2} CV^2 = \frac{q^2}{2C}$$

$$C_P = C_1 + C_2 + ...$$

$$\frac{1}{C_S} = \frac{1}{C_1} + \frac{1}{C_2} + ...$$

$$I = \frac{\Delta q}{\Delta t}$$

$$V = IR$$

$$R = \rho \frac{L}{A}$$

$$P = IV$$

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

$$R_S = R_1 + R_2 + ...$$

$$\frac{1}{R_P} = \frac{1}{R_1} + \frac{1}{R_2} + ...$$

$$q = q_\infty [1 - e^{-t/(RC)}]$$

$$\tau = RC$$

$$q = q_0 e^{-t/(RC)}$$

$$F = q_0 v B \sin\theta$$

$$F_c = \frac{mv^2}{r}$$

$$r = \frac{mv}{qB}$$

$$F = ILB \sin\theta$$

$$\tau = NIAB \sin\phi$$

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

$$B = \mu_0 nI$$

$$\mathcal{E} = vBL$$

$$\Phi = BA\cos\phi$$

$$\mathcal{E} = -N \frac{\Delta\Phi}{\Delta t}$$

$$\mathcal{E} = NAB\omega \sin\omega t = \mathcal{E}_{\max} \sin\omega t$$

$$\omega = 2\pi f$$

$$L = \frac{N\Phi}{I}$$

$$\mathcal{E} = -L \frac{\Delta I}{\Delta t}$$

$$L = \mu_0 n^2 A\ell$$

$$I = I_0 \, e^{-t/(RC)}$$

$$U = LI^2 / 2$$

$$\frac{V_s}{V_p} = \frac{N_s}{N_p}$$

$$\frac{I_s}{I_p} = \frac{V_p}{V_s} = \frac{N_p}{N_s}$$

$$I_{rms} = \frac{I_{\max}}{\sqrt{2}}$$

$$V_{rms} = \frac{V_{\max}}{\sqrt{2}}$$

$$X_C = \frac{1}{\omega C}$$

$$X_L = \omega L$$

$$V_{L,\max} = I_{\max} X_L$$
$$V_{C,\max} = I_{\max} X_C$$
$$V_{gen,\max} = I_{\max} Z$$

$$Z = \sqrt{R^2 + (X_L - X_C)^2}$$

$$I = I_{\max} \sin(\omega t)$$

$$V_{gen} = V_{gen,\max} \sin(\omega t + \phi)$$

$$V_C = I_{max} X_C sin(2\pi ft - \pi/2)$$

$$V_L = I_{max} X_L sin(2\pi ft + \pi/2)$$

$$\tan\phi = \frac{X_L - X_C}{R}$$

$$\overline{P} = I_{rms} V_{rms,gen} \cos\phi$$

$$\overline{P} = I_{\max} V_{R,\max} / 2$$

$$f_0 = \frac{1}{2\pi\sqrt{LC}}$$

$$\lambda = \frac{c}{f}$$

$$c = \frac{1}{\sqrt{\varepsilon_0 \mu_0}}$$

$$\frac{Electric\ energy}{Volume} = \frac{1}{2}\varepsilon_0 E^2$$

$$\frac{Magnetic\ energy}{Volume} = \frac{1}{2\mu_0} B^2$$

$$E = cB$$

$$S = c\varepsilon_0 E_{rms}^2$$

$$f' = f\left(1 \pm \frac{u}{c}\right)$$

$$I = I_0 \cos^2\theta$$

$$\theta_r = \theta_i$$

$$\frac{1}{d_0} + \frac{1}{d_i} = \frac{1}{f}$$

$$m = \frac{h_i}{h_0} = -\frac{d_i}{d_0}$$

$$n = \frac{c}{\mathrm{v}}$$

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

$$\sin\theta_c = \frac{n_2}{n_1}$$

$$M = \frac{\theta'}{\theta} \approx \frac{d_{near}}{f}$$

$$\sin\theta = m\frac{\lambda}{d}$$

$$\sin\theta = \left(m + \frac{1}{2}\right)\frac{\lambda}{d}$$

$$\lambda_{film} = \frac{\lambda_{vacuum}}{n}$$

$$\sin\theta = 1.22\frac{\lambda}{D}$$

$$\sin\theta = m\frac{\lambda}{W}$$

$$|\delta_2 - \delta_1| = m$$

$$|\delta_2 - \delta_1| = \left(m + 1/2\right)$$

$$\Delta t = \frac{\Delta t_0}{\sqrt{1 - \frac{v^2}{c^2}}}$$

$$L = L_0\sqrt{1 - \frac{v^2}{c^2}}$$

$$E = hf$$

$$hf = KE_{\max} + W_0$$

$$\lambda = \frac{h}{p}$$

$$(\Delta p_y)(\Delta y) \geq \frac{h}{4\pi}$$

$$E_i - E_f = hf$$

$$L_n = mv_n r_n = n\frac{h}{2\pi}$$

$$r_n = \left(\frac{h^2}{4\pi^2 mke^2}\right)\frac{n^2}{Z}$$

$$r_n = (5.29\times10^{-11} m)\frac{n^2}{Z}$$

$$E_n = -\left(\frac{2\pi^2 mk^2 e^4}{h^2}\right)\frac{Z^2}{n^2}$$

$$E_n = -(13.6eV)\frac{Z^2}{n^2}$$

$$\frac{1}{\lambda} = RZ^2\left(\frac{1}{n_f^2} - \frac{1}{n_i^2}\right)$$

$$2\pi r = n\lambda \quad n = 1, 2, 3, \ldots$$

$$L = \sqrt{\ell(\ell+1)}\,\frac{h}{2\pi}$$

$$L_z = m_\ell \frac{h}{2\pi}$$

$$A = Z + N$$

$$r \approx (1.2\times10^{-15}\,m)A^{1/3}$$

$$\frac{\Delta N}{\Delta t} = -\lambda N$$

$$N = N_0 e^{-\lambda t} = N_0 \cdot 2^{-\frac{t}{T_{1/2}}}$$

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

$$\lambda_{max}\, T = 2.898 \times 10^{-3}\ K\cdot m$$

$$k = 8.99\times10^9\, Nm^2/C^2$$

$$\varepsilon_0 = 8.85\times10^{-12}\, C^2/Nm^2$$

$$e = 1.60\times10^{-19}\, C$$

$$1\ gauss = 10^{-4}\, tesla$$

$$\mu_0 = 4\pi\times10^{-7}\, T\cdot m/A$$

$$c = 3\times10^8\, m/s$$

$$h = 6.626\,0755\times10^{-34}\, J\cdot s$$

$$R = 1.097\times10^7\, m^{-1}$$

$$hc = 1240\, nm\cdot eV$$

$$1\, eV = 1.6\times10^{-19}\ J$$

$M_{proton} = 1.67\text{x}10^{-27}$ kg
$= 938$ MeV/c^2

$M_{electron} = 9.1\text{x}10^{-31}$ kg
$= 511$ keV/c^2

$$L = L_0\sqrt{1-\frac{v^2}{c^2}}$$

$$\Delta t_0 = \Delta t\sqrt{1-\frac{v^2}{c^2}}$$