$$y(x,t) = y_m \sin(kx \pm \omega t)$$

$k = \frac{2\pi}{\lambda}$	$\omega = \frac{2\pi}{T} = 2\pi f$
$v = \sqrt{\tau/\mu}$	$P_{avg} = \frac{1}{2}\mu v \omega^2 y_m^2$

$$y'(x,t) = [2y_m \cos\frac{1}{2}\phi]\sin(kx - \omega t + \phi/2)$$

$$y'(x,t) = [2y_m \sin kx]\cos\omega t$$

$$f = \frac{v}{\lambda} = n\frac{v}{2L} \qquad n = 1, 2, 3, ...$$

$$s = s_m \cos(k x - \omega t)$$

$$\Delta p = \Delta p_m \sin(kx - \omega t)$$

$v = \sqrt{B/\rho}$	$\Delta p_m = \rho v \omega s_m$
$\Delta L/\lambda = 1, 2, 3, 4, ...$	$\Delta L/\lambda = 0.5, 1.5, 2.5, ...$
$\phi = \frac{\Delta L}{\lambda} 2\pi$	$I = \frac{P_s}{4\pi r^2}$
$I = \frac{1}{2}\rho v \omega^2 s_m^2$	$\beta = (10dB)\log\frac{I}{I_o}$
$f' = f\frac{v \pm v_D}{v \pm v_S}$	$f = n\frac{v}{4L}$; $n = 1, 3, 5, ...$
$T_C = T - 273^o$	$T_F = \frac{9}{5}T_C + 32^o$
$\Delta L = L\alpha\Delta T$	$\Delta V = V\beta\Delta T$; $\beta = 3\alpha$
$Q = Lm$	$Q = cm\Delta T$
$\Delta E_{\text{int}} = Q - W$	$W = \int dW = \int_{V_i}^{V_f} PdV$
$P_{rad} = \sigma\varepsilon A T^4$	$P_{abs} = \sigma\varepsilon A T_{env}^4$

$$P_{cond} = \frac{Q}{t} = kA\frac{T_H - T_C}{L}$$

$PV = nRT = NkT$	$W = nRT\ln\frac{V_f}{V_i}$
$v_{rms} = \sqrt{\frac{3RT}{M}}$	$K_{avg} = \frac{3}{2}kT$
$C_V = \frac{Q}{n\Delta T}$	$C_P = \frac{Q}{n\Delta T}$
$C_P = C_V + R$	$\Delta E_{\text{int}} = nC_V\Delta T$

$$C_V = \frac{3}{2}R; \quad \gamma = \frac{C_p}{C_V}$$

$TV^{\gamma-1} = Constant$	$PV^{\gamma} = Constant$

$\Delta S = \int_i^f \frac{dQ}{T}$	$\Delta S = mc\ln\left(\frac{T_f}{T_i}\right)$

$$\Delta S = nR\ln\left(\frac{V_f}{V_i}\right) + nc_V\ln\left(\frac{T_f}{T_i}\right)$$

$W = \lvert Q_H\rvert - \lvert Q_L\rvert$	$\frac{\lvert Q_H\rvert}{T_H} = \frac{\lvert Q_L\rvert}{T_L}$
$\varepsilon = \frac{\lvert W\rvert}{\lvert Q_H\rvert}$	$K = \frac{\lvert Q_L\rvert}{\lvert W\rvert}$

$$\varepsilon_c = 1 - \frac{\lvert Q_L\rvert}{\lvert Q_H\rvert} = 1 - \frac{T_L}{T_H}$$

$$K_c = \frac{\lvert Q_L\rvert}{\lvert Q_H\rvert - \lvert Q_L\rvert} = \frac{T_L}{T_H - T_L}$$

$$F = \frac{1}{4\pi\varepsilon_o}\frac{\lvert q_1\rvert\lvert q_2\rvert}{r^2}$$

$E = \frac{1}{4\pi\varepsilon_o}\frac{\lvert q\rvert}{r^2}$	$E = \frac{\sigma}{2\varepsilon_o}$
$\Phi = \oint \vec{E}.d\vec{A}$	$\vec{E} = \frac{\vec{F}}{q_o}$
$E = \left(\frac{q}{4\pi\varepsilon_o R^3}\right)r$	$\varepsilon_o\Phi_{net} = q_{enc}$
$\vec{\tau} = \vec{p}\times\vec{E}$	$E = \frac{\sigma}{\varepsilon_o}$
$p = qd$	$U = -\vec{p}.\vec{E}$
$\Delta U = q\Delta V$	$E = \frac{\lambda}{2\pi\varepsilon_o r}$
$V_{if} = V_f - V_i = -\int_i^f \vec{E}\cdot d\vec{s}$	$\Delta U = -W$
$V = \sum_{i=1}^n V_i = \frac{1}{4\pi\varepsilon_o}\sum_{i=1}^n \frac{q_i}{r_i}$	$V = \frac{1}{4\pi\varepsilon_o}\frac{q}{r}$

$$E_x = -\frac{\partial V}{\partial x}; E_y = -\frac{\partial V}{\partial y}; E_z = -\frac{\partial V}{\partial z}$$

$U = \frac{1}{4\pi\varepsilon_o}\frac{q_1 q_2}{r}$	$q = CV$
$U = \frac{q^2}{2C} = \frac{1}{2}CV^2$	$u = \frac{1}{2}\varepsilon_o E^2$
$C = 2\pi\varepsilon_o\frac{L}{\ln(b/a)}$	$C = \frac{\varepsilon_o A}{d}$
$C = 4\pi\varepsilon_o\frac{ab}{b-a}$	$C = \kappa C_{air}$

$i = \frac{dq}{dt}$	$J = (ne)v_d$	$i = \int \vec{J}.d\vec{A}$
$\rho = \frac{1}{\sigma} = \frac{E}{J}$	$P = iV$	$R = \frac{V}{i} = \rho\frac{L}{A}$

$\rho - \rho_o = \rho_o\alpha(T - T_o)$	$q = q_o e^{-t/RC}$
$q = C\varepsilon\left(1 - e^{-t/RC}\right)$	$i = -\left(\frac{q_o}{RC}\right)e^{-t/RC}$
$i = \left(\frac{\varepsilon}{R}\right)e^{-t/RC}$	$\vec{\tau} = \vec{\mu}\times\vec{B}$
$\vec{F}_B = q\left(\vec{v}\times\vec{B}\right)$	$\mu = NiA$
$\vec{F}_B = i\left(\vec{L}\times\vec{B}\right)$	$U(\theta) = -\vec{\mu}.\vec{B}$
$B = \frac{\mu_o i\phi}{4\pi R}$	$d\vec{B} = \frac{\mu_o}{4\pi}\frac{i\left(d\vec{s}\times\hat{r}\right)}{r^2}$
$B = \frac{\mu_o i}{2\pi R}$	$\oint \vec{B}.d\vec{s} = \mu_o i_{enc}$
$B = \mu_o ni$	$F_{ba} = \frac{\mu_o L i_a i_b}{2\pi d}$
$P = \frac{B^2L^2v^2}{R}$	$\Phi_{net} = \int \vec{B}.d\vec{A}$
$\varepsilon = -N\frac{d\Phi_B}{dt}$	$\varepsilon = BLv$

$$\vec{F} = m\vec{a}; \quad F_r = \frac{mv^2}{R}$$

$$v = v_o + at; \quad \Delta x = v_o t + \frac{1}{2}at^2; \quad v^2 = v_o^2 + 2a\Delta x$$

$$\Delta k + \Delta U = 0; \quad K = \frac{1}{2}mv^2$$

CONSTANTS

$\varepsilon_o = 8.854\times10^{-12}\ \text{C}^2/\text{N}\cdot\text{m}^2$	
$N_A = 6.022\times10^{23}\ \text{mole}^{-1}$	
$\sigma = 5.6704\times10^{-8}\ \text{W}/\text{m}^2\cdot\text{K}^4$	
$1atm = 1.01\times10^5\ \text{N}/\text{m}^2$	
$1eV = 1.602\times10^{-19}\ \text{J}$	$v_{air} = 343\ \text{m/s}$
$\lvert e\rvert = 1.602\times10^{-19}\ \text{C}$	$I_o = 10^{-12}\ \text{W}/\text{m}^2$
$\mu_o = 4\pi\times10^{-7}\ \text{T}\cdot\text{m}/\text{A}$	$m_e = 9.11\times10^{-31}\text{kg}$
$m_p = 1.673\times10^{-27}\ \text{kg}$	$g = 9.8\ \text{m/s}^2$
$R = 8.314\ \text{J/mole.K}$	$1\ L = 10^{-3}\ \text{m}^3$
$k = 1.381\times10^{-23}\ \text{J/K}$	$1cal = 4.1868\ \text{J}$

FOR WATER

$c = 4187\ \text{J/kg.K}$	$\rho = 1000\ kg/m^3$
$L_V = 2256\ \text{kJ/kg}$	$L_F = 333\ \text{kJ/kg}$

PREFIXES

$k = kilo = 10^3$	$m = milli = 10^{-3}$
$M = mega = 10^6$	$\mu = micro = 10^{-6}$
$G = giga = 10^9$	$n = nano = 10^{-9}$
$T = tera = 10^{12}$	$p = pico = 10^{-12}$