Units and Constants

$$e = 1.6 \times 10^{-19}\ \text{C}$$
$$m_e = 9.11 \times 10^{-31}\ \text{kg}$$
$$k = 8.99 \times 10^{9}\ \text{Nm}^2/\text{C}^2$$
$$\epsilon_0 = 8.85 \times 10^{-12}\ \text{C}^2/\text{Nm}^2$$
$$\mu_0 = 4\pi \times 10^{-7}\ \text{Tm/A}$$
$$c = 2.998 \times 10^{8}\ \text{m/s}$$
$$v = 343\ \text{m/s}$$

MATH FORMULAS

AREA

circle : πR^2 sphere : $4\pi R^2$

cylinder(curved part) : $2\pi RL$

VOLUME

sphere : $\frac{4}{3}\pi R^3$ cylinder : $\pi R^2 L$

OTHER

$$ds = rd\theta \qquad \frac{d}{dx}\left(x^n\right) = nx^{n-1}$$
$$\int x^n dx = \frac{x^{n+1}}{n+1} \qquad \int \frac{dx}{x} = \ln x$$
$$\int \frac{dx}{\left(x^2+a^2\right)^{1/2}} = \ln\left(x + \sqrt{x^2+a^2}\right)$$
$$\int \frac{x\,dx}{\left(x^2+a^2\right)^{3/2}} = -\frac{1}{\left(x^2+a^2\right)^{1/2}}$$
$$\int \frac{dx}{\left(x^2+a^2\right)^{3/2}} = \frac{x}{a^2\left(x^2+a^2\right)^{1/2}}$$

CHAPTER 25

$$q = CV \qquad V = Ed$$
$$E = \frac{q}{\epsilon_0 A} \qquad C = \frac{\epsilon_0 A}{d}$$
$$C_{\text{eq}} = C_1 + C_2 + C_3 + ...$$
$$\frac{1}{C_{\text{eq}}} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3} + ...$$
$$U = \frac{q^2}{2C} \qquad U = \frac{1}{2}CV^2$$
$$C = \kappa C_0 \qquad E = \frac{q}{\kappa\epsilon_0 A}$$

ELECTROSTATICS

$$F = \frac{kq_1q_2}{r^2} = \frac{1}{4\pi\epsilon_0}\frac{q_1q_2}{r^2}$$
$$\vec{E} = \frac{\vec{F}}{q_0} \qquad \vec{F} = q_0\vec{E}$$
$$E = \frac{q}{4\pi\epsilon_0 r^2}$$
$$\Phi = \vec{v}\cdot\vec{A} = vA\cos\theta$$
$$\Phi = \int \vec{E}\cdot d\vec{A}$$
$$\epsilon_0\Phi = q_{\text{enc}}$$
$$\epsilon_0 \oint \vec{E}\cdot d\vec{A} = q_{\text{enc}}$$
$$\lambda = \frac{\text{charge}}{\text{length}} \qquad \sigma = \frac{\text{charge}}{\text{area}}$$
$$\rho = \frac{\text{charge}}{\text{volume}}$$
$$E = \frac{\sigma}{\epsilon_0} \qquad E = \frac{\sigma}{2\epsilon_0}$$

CHAPTER 24

$$W_{\text{app}} = -W = U_f - U_i$$
$$V = \frac{U}{q_0}$$
$$\Delta V = V_f - V_i = \frac{U_f}{q_0} - \frac{U_i}{q_0} = \frac{\Delta U}{q_0}$$
$$V_f - V_i = -\int_i^f \vec{E}\cdot d\vec{s}$$
$$V = \frac{q}{4\pi\epsilon_0 r}$$
$$E_s = -\frac{\partial V}{\partial s} \qquad E_x = -\frac{\partial V}{\partial x}$$
$$E_y = -\frac{\partial V}{\partial y} \qquad E_z = -\frac{\partial V}{\partial z}$$
$$U = \frac{1}{4\pi\epsilon_0}\frac{q_1q_2}{r_{12}}$$

CHAPTER 26

$$i = \frac{dq}{dt} \qquad q = \int i\,dt$$
$$J = \frac{i}{A} \qquad i = \int \vec{J}\cdot d\vec{A}$$
$$v_d = \frac{i}{neA} = \frac{J}{ne}$$
$$V = iR \qquad \vec{E} = \rho\vec{J}$$
$$R = \rho\frac{L}{A} \qquad P = iV = i^2R = \frac{V^2}{R}$$

CHAPTER 28

$$\vec{F} = q\left(\vec{v}\times\vec{B}\right) \qquad |\vec{F}_B| = qvB\sin\theta$$
$$n = \frac{Bi}{V\ell e}$$
$$r = \frac{mv}{qB} \qquad f = \frac{qB}{2\pi m}$$
$$f = \frac{qB}{2\pi m}$$
$$\vec{F} = i\vec{L}\times\vec{B}$$
$$\tau = NiAB\sin\theta$$

CHAPTER 29

$$d\vec{B} = \frac{\mu_0}{4\pi}\frac{id\vec{s}\times\vec{r}}{r^3}$$
$$dB = \frac{\mu_0}{4\pi}\frac{ids\sin\theta}{r^2}$$
$$B = \frac{\mu_0 i}{4\pi R}\left[\frac{s}{\sqrt{s^2+R^2}}\right]_a^b$$
$$B = \frac{\mu_0 i}{2\pi R} \qquad B = \frac{\mu_0 i}{4\pi R}\phi$$
$$F_{ba} = \frac{\mu_0 L i_a i_b}{2\pi d}$$
$$\oint \vec{B}\cdot d\vec{s} = \mu_0 i_{\text{enc}}$$
$$B = \mu_0 in$$

CHAPTER 30

$$\Phi_B = \vec{B}\cdot\vec{A} \qquad \Phi_B = \oint \vec{B}\cdot d\vec{A}$$
$$\mathcal{E} = -N\frac{d\Phi_B}{dt}$$
$$\mathcal{E} = Blv \qquad P = \frac{B^2l^2v^2}{R}$$

CHAPTER 16

$$y(x,t) = y_m\sin(kx-\omega t)$$
$$k = \frac{2\pi}{\lambda} \qquad f = \frac{\omega}{2\pi} \qquad f = \frac{1}{T}$$
$$v = \frac{\omega}{k} = \frac{\lambda}{T} = \lambda f \qquad v = \sqrt{\frac{\tau}{\mu}}$$
$$y = \left[2y_m\cos\left(\frac{\phi}{2}\right)\right]\sin\left(kx-\omega t+\frac{\phi}{2}\right)$$
$$P_{\text{avg}} = \frac{1}{2}\mu v\omega^2 y_m^2$$
$$f = \frac{v}{2L}n \qquad f = \frac{v}{4L}n$$

CHAPTER 17

$$\frac{\phi}{2\pi} = \frac{\Delta L}{\lambda} = \frac{\Delta t}{T}$$
$$I = \frac{P}{A} \qquad I = \frac{P}{4\pi r^2}$$
$$I = \frac{1}{2}\rho v\omega^2 s_m^2$$
$$\beta = (10\text{dB})\log\frac{I}{I_0} \qquad I_0 = 10^{-12}\text{W/m}^2$$
$$f_{\text{beats}} = |f_1 - f_2| \qquad f' = f\left(\frac{v\pm v_D}{v\pm v_S}\right)$$

CHAPTER 35

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