Appendix E
Equations

Chapter 2

$y = mx + b$

$m = \dfrac{rise}{run} = \dfrac{\Delta y}{\Delta x}$

$y = ax^2 + bx + c$

$xy = a$

Chapter 3

$\bar{\boldsymbol{v}} \equiv \dfrac{\Delta \boldsymbol{d}}{\Delta t} = \dfrac{\boldsymbol{d}_1 - \boldsymbol{d}_0}{t_1 - t_0}$

$\Delta \boldsymbol{d} = \bar{\boldsymbol{v}} \Delta t$

$\bar{\boldsymbol{a}} \equiv \dfrac{\Delta \boldsymbol{v}}{\Delta t} = \dfrac{\boldsymbol{v}_1 - \boldsymbol{v}_0}{t_1 - t_0}$

Chapter 4

$R^2 = A^2 + B^2$

$R^2 = A^2 + B^2 - 2AB\cos\theta$

$A_x = A\cos\theta$; therefore, $\cos\theta = \dfrac{\text{adjacent side}}{\text{hypotenuse}} = \dfrac{A_x}{A}$

$A_y = A\sin\theta$; therefore, $\sin\theta = \dfrac{\text{opposite side}}{\text{hypotenuse}} = \dfrac{A_y}{A}$

$\tan\theta = \dfrac{R_y}{R_x}$

Chapter 5

$\bar{v} = \dfrac{\Delta d}{\Delta t} = \dfrac{d_1 - d_0}{t_1 - t_0}$

$d = d_0 + vt$

$\bar{a} = \dfrac{\Delta v}{\Delta t} = \dfrac{v_1 - v_0}{t_1 - t_0}$

$v = v_0 + at$

$d = d_0 + 1/2(v + v_0)t$

$d = d_0 + v_0 t + 1/2at^2$

$v^2 = v_0{}^2 + 2a(d - d_0)$

Chapter 6

$\boldsymbol{a} = \dfrac{\boldsymbol{F}_{\text{net}}}{m}$

$F_{\text{f, kinetic}} = \mu_k F_N$

$0 \le F_{\text{f, static}} \le \mu_s F_N$

$T = 2\pi\sqrt{\dfrac{l}{g}}$

$F_{\text{A on B}} = -F_{\text{B on A}}$

Chapter 7

$a_c = \dfrac{v^2}{r}$

$F_{\text{net}} = ma_c$

Chapter 8

$\left(\dfrac{T_A}{T_B}\right)^2 = \left(\dfrac{r_A}{r_B}\right)^3$

$F = G\dfrac{m_A m_B}{d^2}$

$T^2 = \left(\dfrac{4\pi^2}{Gm_s}\right)r^3$

$v = \sqrt{\dfrac{Gm_E}{r}}$

$T = 2\pi\sqrt{\dfrac{r^3}{Gm_E}}$

$\boldsymbol{g} = \dfrac{\boldsymbol{F}}{m}$

Chapter 9

$\boldsymbol{p} = m\boldsymbol{v}$

$\boldsymbol{F}\Delta t = \boldsymbol{p}_2 - \boldsymbol{p}_1$

$\boldsymbol{p}_{A2} + \boldsymbol{p}_{B2} = \boldsymbol{p}_{A1} + \boldsymbol{p}_{B1}$

Chapter 10

$K = 1/2mv^2$

$W = Fd$

$\Delta K = W$

$W = Fd\cos\theta$

$P = \dfrac{W}{t}$

$MA = \dfrac{F_r}{F_e}$

$IMA = \dfrac{d_e}{d_r}$

$\text{efficiency (\%)} = \dfrac{W_o}{W_i} \times 100$

$\text{efficiency (\%)} = \dfrac{MA}{IMA} \times 100$

Chapter 11

$U_g = mgh$

$E = K + U_g$

$K_{\text{before}} + U_{g\,\text{before}} = K_{\text{after}} + U_{g\,\text{after}}$

Chapter 12

$Q = mC\Delta T = mC(T_{\text{final}} - T_{\text{initial}})$

$E_A + E_B = constant$

$Q = mH_f$

$Q = mH_v$

Chapter 13

$P = \dfrac{F}{A}$

$F_2 = \dfrac{F_1 A_2}{A_1}$

$P = \dfrac{F_g}{A} = \rho hg$

$F_{\text{buoyant}} = \rho Vg$

$\alpha = \Delta L/L_1 \Delta T$

Chapter 14

$$f = \frac{1}{T}$$

$$v = \lambda f$$

Chapter 16

$$E = \frac{P}{4\pi d^2}$$

Chapter 17

$$n_i \sin \theta_i = n_r \sin \theta_r$$

$$n_{substance} = \frac{c}{v_{substance}}$$

Chapter 18

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

$$m = \frac{h_i}{h_o}$$

$$m = \frac{-d_i}{d_o}$$

Chapter 19

$$\lambda = \frac{xd}{L}$$

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

Chapter 20

$$F = K \frac{q_A q_B}{d^2}$$

Chapter 21

$$\boldsymbol{E} = \frac{\boldsymbol{F}_{on\ q'}}{q'}$$

$$\Delta V = \frac{W_{on\ q'}}{q'}$$

$$\Delta V = Ed$$

$$C = \frac{q}{\Delta V}$$

Chapter 22

$$P = IV$$

$$R = \frac{V}{I}$$

$$P = I^2 R$$

Chapter 23

$$R = R_A + R_B + \ldots$$

$$I = \frac{V_{source}}{R}$$

$$\frac{1}{R} = \frac{1}{R_A} + \frac{1}{R_B} + \frac{1}{R_C}$$

Chapter 24

$$F = BIL$$

$$F = Bqv$$

Chapter 25

$$EMF = BLv$$

$$I_{eff} = 0.707\ I_{max}$$

$$V_{eff} = 0.707\ V_{max}$$

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

Chapter 26

$$\frac{q}{m} = \frac{v}{Br}$$

$$\frac{q}{m} = \frac{2V}{B^2 r^2}$$

Chapter 27

$$E = nhf$$

$$E = hf = \frac{hc}{\lambda}$$

$$K = hf - hf_0$$

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

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

Chapter 28

$$\Delta E = hf$$

$$r_n = \frac{h^2 n^2}{4\pi^2 Kmq^2}$$

$$E_n = -13.6\ \text{eV} \times \frac{1}{n^2}$$

$$n\lambda = 2\pi r$$

Chapter 30

$$E = mc^2$$

Chapter 31

$$E = mc^2$$