BPT REFERENCE SHEET

Unit Conversions & Constants

$g = 9.8\,\mathrm{m/s^2}$

$c = 3.00 \times 10^8\,\mathrm{m/s}$

$G = 6.67 \times 10^{-11}\,\mathrm{m^3/(kg\,s^2)}$

$k = 8.99 \times 10^9\,\mathrm{kg\,m^3 s^{-2} C^{-2}}$

$1\,\mathrm{atm} = 101325\,\mathrm{Pa}$

$1\,\mathrm{eV} = 1.602 \times 10^{-19}\,\mathrm{J}$

$\mu_0 = 4\pi \times 10^{-7}\,\mathrm{kg\,s^{-2} A^{-2}}$

$m_p = 1.67 \times 10^{-27}\,\mathrm{kg}$

$m_e = 9.109 \times 10^{-31}\,\mathrm{kg}$

$N_A = 6.022 \times 10^{23}\,\mathrm{mol^{-1}}$

$k_B = 1.38 \times 10^{-23}\,\mathrm{m^2 kg\,s^{-2} K^{-1}}$

$h = 6.626 \times 10^{-34}\,\mathrm{m^2 kg/s}$

Formulas

$$I = \sum_{i=1}^{n} m_i r_i^2$$

$$I_{\text{rod about center}} = \frac{1}{12} M L^2$$

$$I_{\text{rod about end}} = \frac{1}{3} M L^2$$

$$I_{\text{disk}} = \frac{1}{2} M R^2$$

$$I_{\text{sphere}} = \frac{2}{5} M R^2$$

$$I_{\text{hollow sphere}} = \frac{2}{3} M R^2$$

$$Q = mc\Delta T$$

$$\Delta U = Q - W$$

$$\Delta L = \alpha L_0 \Delta T$$

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

$$V = IR$$

$$\mathbf{E} = -\nabla V$$

$$\nabla \times E = -\frac{dB}{dt}$$

$$\gamma = \left(1 - \beta^2\right)^{-\frac{1}{2}}$$

$$t' = \gamma(t - \frac{vx}{c^2})$$

$$x' = \gamma(x - vt)$$

$$u' = \frac{u + v}{1 + \frac{uv}{c^2}}$$

$$\vec{p} = \gamma m \vec{v}$$

$$\vec{F} = qE + q\vec{v} \times B$$

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

Trigonometry, Calculus, & Approximations

$$\sin^2\theta + \cos^2\theta = 1$$

$$\sin(2\theta) = 2\sin(\theta)\cos(\theta)$$

$$\cos(2\theta) = \cos^2(\theta) - \sin^2(\theta)$$

$$\tan 2\theta = \frac{2\tan\theta}{1 - \tan^2\theta}$$

$$\frac{d}{dx}[x^n] = nx^{n-1}$$

$$(1 + x)^n \approx 1 + xn \text{ for } |nx| \ll 1$$

$$e^x \approx 1 + x \text{ for } |x| \ll 1$$

$$\sin\theta \approx \theta - \theta^3/6 \text{ for } |\theta| \ll 1$$

$$\cos\theta \approx 1 - \theta^2/2 \text{ for } |\theta| \ll 1$$

$$\frac{d}{dx}[f(x) \cdot g(x)] = f'(x)g(x) + g'(x)f(x)$$

$$\frac{d}{dx}[f(g(x))] = f'(g(x)) \cdot g'(x)$$

$$\int \frac{k}{x}\,dx = k\ln|x| + C$$

$$\nabla\phi = \frac{\partial\phi}{\partial x}\hat{x} + \frac{\partial\phi}{\partial y}\hat{y} + \frac{\partial\phi}{\partial z}\hat{z}$$