

Formula Sheet

$$\varepsilon = \frac{d}{2a}$$

$$T^2 = a^3$$

$$\frac{v_p}{v_a} = \frac{1 + \varepsilon}{1 - \varepsilon}$$

$$x = vt$$

$$v = at$$

$$x = \frac{1}{2}at^2$$

$$F_{A \rightarrow B} = -F_{B \rightarrow A}$$

$$E_k = \frac{1}{2}mv^2$$

$$F_G = G \frac{M_A M_B}{r^2}$$

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

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

$$T^2 = \frac{4\pi^2}{G(M_1 + M_2)} a^3$$

$$M_1 r_1 = M_2 r_2$$

$$r_2 = a \frac{M_1}{M_1 + M_2}$$

$$p = mv$$

$$L = p \times r$$

$$L = mvr$$

$$E_{potential} = -G \frac{M_1 M_2}{r}$$

$$E_{total} = E_{potential} + E_{kinetic}$$

$$v_{escape} = \sqrt{\frac{2GM_E}{R_E}}$$

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

$$\lambda f = c$$

$$\lambda_{max} = \frac{2.9 \times 10^6}{T}$$

$$L = \sigma T^4$$

$$I = \frac{1}{2}c\varepsilon_0 E^2$$

$$B = E/c$$

$$P = \frac{I}{c}$$

$$I(r, \theta) = \frac{\pi^2 p_0^2}{2\varepsilon_0 c^3} \cdot f^4 \cdot \frac{\sin^2 \theta}{r^2}$$

$$p_\gamma = \frac{h}{\lambda} = \frac{E_\gamma}{c}$$

$$M_\gamma = 0$$

$$f' = f + \Delta f$$

$$\frac{\Delta f}{f} = -\frac{\Delta \lambda}{\lambda} = \frac{v_{\parallel}}{c}$$

$$v_{\parallel} = v \cos \theta$$

$$G = 6.6743 \times 10^{-11} \text{ m}^3/\text{kg}\cdot\text{s}^2$$

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

$$\sigma = 5.67 \times 10^{-8} \text{ W}/(\text{m}^2\cdot\text{K}^4)$$

$$h = 6.626 \times 10^{-34} \text{ J}\cdot\text{s}$$

$$\varepsilon_0 = 8.85 \times 10^{-12} \text{ C}^2/(\text{N}\cdot\text{m}^2)$$

$$c = 3.0 \times 10^8 \text{ m/s}$$

$$m_p = 1.67265 \times 10^{-27} \text{ kg}$$

$$m_n = 1.67495 \times 10^{-27} \text{ kg}$$

$$m_e = 9.11 \times 10^{-31} \text{ kg}$$

$$1 \text{ AU} = 149.6 \times 10^6 \text{ km}$$

$$M_{Earth} = 5.97 \times 10^{24} \text{ kg}$$

$$R_{Earth} = 6371 \text{ km}$$

$$M_{Sun} = 1.99 \times 10^{30} \text{ kg}$$

$$R_{Sun} = 6.96 \times 10^5 \text{ km}$$

$$M_{Moon} = 7.34 \times 10^{22} \text{ kg}$$

$$R_{Moon} = 1737 \text{ km}$$