

$$v = f\lambda \quad v = \sqrt{\frac{F_T}{\mu}} \quad y(x,t) = A \sin \left[2\pi f \left(t - \frac{x}{v} \right) \right] = A \sin \left[2\pi \left(\frac{t}{T} - \frac{x}{\lambda} \right) \right]$$

$$f_n = n \left(\frac{v}{2L} \right), \quad n=1,2,3,\dots \quad f_n = n \left(\frac{v}{4L} \right), \quad n=1,3,5,\dots$$

$$I = \frac{P}{4\pi r^2} \quad \beta = (10 \text{ dB}) \log \left(\frac{I}{I_0} \right) \quad f_{\text{beat}} = f_1 - f_2 \quad f_L = \left(\frac{v+v_L}{v+v_S} \right) f_S$$

$$T_F = \frac{9}{5} T_C + 32^\circ \quad T_C = \frac{5}{9} (T_F - 32^\circ) \quad T_K = T_C + 273.15^\circ \quad 1 \text{ C}^\circ = \frac{9}{5} \text{ F}^\circ$$

$$\Delta L = \alpha L_0 \Delta T \quad \Delta V = V_0 \beta \Delta T \quad \frac{F}{A} = -Y \alpha \Delta T$$

$$Q = mc\Delta T \quad Q = \pm mL$$

$$H = kA \frac{T_H - T_C}{L} \quad H = Ae\sigma T^4 \quad \sigma = 5.67 \times 10^{-8} \text{ W}/(\text{m}^2 \cdot \text{K}^4)$$

$$N = 6.022 \times 10^{23} \text{ molecules/mol} \quad m_{\text{total}} = nM$$

$$pV = nRT \quad \rho = \frac{pM}{RT} \quad R = 8.314 \text{ J}/(\text{mol} \cdot \text{K})$$

$$K_{\text{tr}} = \frac{3}{2} nRT \quad K_{\text{av}} = \frac{1}{2} m(v^2)_{\text{av}} = \frac{3}{2} kT \quad pV = NkT$$

$$v_{\text{rms}} = \sqrt{\frac{3kT}{m}} = \sqrt{\frac{3RT}{M}} \quad Q = nC\Delta T$$

$$W = p\Delta V \quad W = nRT \ln \left(\frac{V_2}{V_1} \right) \quad \Delta U = Q - W$$

$$C_p = C_v + R \quad p_1 V_1^\gamma = p_2 V_2^\gamma \quad T_1 V_1^{\gamma-1} = T_2 V_2^{\gamma-1} \quad \gamma = C_p / C_v$$

$$W = Q = |Q_H| - |Q_C| \quad e = \frac{W}{Q_H} = 1 - \frac{|Q_C|}{|Q_H|} \quad K = \frac{Q_C}{|W|} = \frac{|Q_C|}{|Q_H| - |Q_C|}$$

$$\text{Carnot: } \frac{Q_C}{Q_H} = -\frac{T_C}{T_H} \quad e_{\text{Carnot}} = 1 - \frac{T_C}{T_H}$$

$$\Delta S = \frac{Q}{T}$$