Physics Box 33

$$t = t_0 \frac{1}{\sqrt{1 - (u/c)^2}} \tag{1}$$

$$\vec{p} = \gamma m_0 \vec{v} = \frac{E_{\text{ph}}}{c} \tag{2}$$

$$E^2 = (pc)^2 + (mc^2)^2 \tag{3}$$

$$v = \frac{v' + u}{1 + v'u/c^2} \tag{4}$$

$$f_{\text{obs}} = f_{\text{src}} \frac{\sqrt{1 - (u/c)^2}}{1 - (u/c)\cos\theta} \tag{5}$$

$$E_{\text{th}} = \frac{3}{2} N k_B T \tag{6}$$

$$\Delta W_{\text{isotherm}} = P_i V_i \log \frac{V_i}{V_f} \tag{7}$$

$$\Delta W_{\text{adiabat}} = \frac{P_i V_i}{\gamma - 1} \left[\left(\frac{V_i}{V_f} \right)^{\gamma - 1} - 1 \right] \tag{8}$$

$$S = k_B \log \Omega \tag{9}$$

$$\Delta S = N k_B \log \frac{V_f}{V_i} \tag{10}$$

$$\eta = \frac{W}{Q_H} = 1 - \frac{Q_C}{Q_H} \tag{11}$$