Useful Equations and Constants

$n_1 \sin\theta_1 = n_2 \sin\theta_2$

$\theta_i = \theta_r$

$\theta_c = \sin^{-1}\left(\frac{n_2}{n_1}\right)$

$n = \frac{c}{v}$

$PV = Nk_BT = nRT$

$\frac{1}{2}mv_{avg}^2 = \frac{3}{2}k_BT$

$Q = mc\Delta T$

$Q_{Total} = \sum_{i=1}^{p} Q_i$

$\Delta E_{\text{internal}} = nC_V\Delta T$

$\Delta E = Q + W$

$PV^{\gamma} = TV^{\gamma-1} = \text{constant}$

$\mathrm{Q_V} = nC_V\Delta T$

$Q_P = nC_P\Delta T$

$Q_L = \pm mL$

$P_C = \frac{\Delta Q}{\Delta t} = \frac{\kappa A}{L}\Delta T$

$\Delta E_{th} = Q + W$

$W = -\int PdV$

$PV^{\gamma} = TV^{\gamma-1} = \text{constant}$

$\mathrm{C_P} = \mathrm{C_V} + \mathrm{R}$

$k_B = 1.38\times10^{-23}\,\frac{J}{K}$

$R = 8.31\frac{J}{mol\times K}$

$N_A = 6.02\times10^{23}$

$C_V = \frac{3}{2}R$

$P_{air} = 1atm = 1.103\times10^5\,Pa$

$T(K) = T(^oC) + 273$

$g = 9.81\frac{m}{s^2}$

$c = 3\times10^8\,\frac{m}{s}$

$d\sin\theta_m = m\lambda$

$a\sin\phi_{m'} = m'\lambda$

$\sin\theta_m \approx \tan\theta_m \approx \theta_m = \frac{y_m}{D}$

$\sin\phi_{m'} \approx \tan\phi_{m'} \approx \phi_{m'} = \frac{y_{m'}}{D}$

$P_{net} = P_{abs} - P_{emit} = \frac{\Delta Q}{\Delta t} = \varepsilon\sigma A\left(T_{hot}^4 - T_{ambient}^4\right)$

$t = \frac{Nk_B}{2\sigma\varepsilon A}\left(\frac{1}{T_{final}^3} - \frac{1}{T_{hot}^3}\right)$

$L_{new} = L_{old}\left(1 + \alpha\Delta T\right)$

$A_{new} = A_{old}\left(1 + 2\alpha\Delta T\right)$

$V_{new} = V_{old}\left(1 + 3\alpha\Delta T\right)$