Exam 3 Equation Sheet:

$$pV = nRT$$

$$pV = Nk_bT$$

$$\frac{\Delta L}{L} = \alpha \Delta T$$

$$\frac{\Delta V}{V} = \beta \Delta T$$

$$N = \frac{M}{m}$$

$$n = \frac{N}{N_A} = \frac{M}{M_{mol}}$$

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

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

$$W = -\int_{V_i}^{V_f} p\,dV$$

$$\gamma = \frac{C_p}{C_V} = \begin{cases} 1.66 \ (monatomic) \\ 1.40 \ (diatomic) \end{cases}$$

$$pV^\gamma = const$$

$$Q = nC\Delta T$$

$$Q = Mc\Delta T$$

$$Q = ML$$

$$C_p = C_V + R$$

$$\frac{dQ}{dt} = \left(\frac{kA}{L}\right)\Delta T$$

$$\frac{dQ}{dt} = e\sigma A T^4$$

$$W = -nRT\ln\left(\frac{V_f}{V_i}\right)$$

$$p = \frac{1}{3}\frac{N}{V}mv_{rms}^2 = \frac{2}{3}\frac{N}{V}\epsilon_{avg}$$

$$\epsilon_{avg} = \frac{3}{2}k_BT$$

$$v_{rms} = \sqrt{(v^2)_{avg}}$$

$$v_{rms} = \sqrt{\frac{3k_BT}{m}} = \sqrt{\frac{3RT}{M_{mol}}}$$

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

Diatomic: $C_V = \frac{5}{2}R$

Solid: $C = 3R$

$$\eta = \frac{W_{out}}{Q_H}$$

$$\eta \leq 1 - \frac{T_C}{T_H}$$

$$K = \frac{Q_C}{W_{in}}$$

$$K \leq \frac{T_C}{T_H - T_C}$$