Exam 1 Equation Sheet

Generally True

$$\Delta U = Q_{\to s} + W_{\to s} \qquad W_{\to s} = -\int_i^f P dV \qquad \binom{N}{n} = \frac{N!}{n!(N-n)!} \qquad N! \approx \left(\frac{N}{e}\right)^N \sqrt{2pN}$$

$$C_V = \left(\frac{\partial U}{\partial T}\right)_{N,V} \qquad Q_{\to s} = C\Delta T = cm\Delta T \qquad \frac{1}{T} \equiv \left(\frac{\partial S}{\partial U}\right)_{N,V} \qquad dS \geq \frac{Q}{T}$$

$$dS = \frac{1}{T}dU + \frac{P}{T}dV - \frac{m}{T}dN \qquad P = T\left(\frac{\partial S}{\partial V}\right)_{U,N} \qquad m = -T\left(\frac{\partial S}{\partial N}\right)_{U,V} \qquad g = \frac{f+2}{f}$$

True under certain conditions

$\Delta U = \frac{f}{2} Nk\Delta T$ where f = # of accessible degrees of freedom.

$$PV = NkT \qquad P_i V_i^{\ g} = P_f V_f^{\ g} \qquad W_{s\to} = NkT \ln\left(\frac{V_f}{V_i}\right)$$

$k = 1.3 \times 10^{-23}$ J/K