Formula sheet for Midterm I PHYS 3113

First law of thermodynamics: $\Delta U = Q + W$

Termodynamic identity: $dU = TdS - pdV$

Ideal gas, equation of state: $PV = nRT = NkT$

Ideal gas, internal energy: $U = \frac{f}{2}nRT = \frac{f}{2}NkT$

Entropy: $S = k \ln \Omega$

Einstein's solid, high temperature approximation: $\Omega = \left(\frac{qe}{N}\right)^N$

Sackur-Tetrode equation: $S = Nk\left[\ln\left(\frac{V}{N}\left[\frac{4\pi mU}{3Nh^2}\right]^{3/2}\right) + \frac{5}{2}\right]$

Boltzmann's constant: $k = 1.38 \times 10^{-23}$ J/K

Gas constant: $R = 8.31$ J/K/mol