Chem 534: Problem Set #9 (advisory only)

(1) The density of sodium metal at room temperature is 0.95 g/cm^3. Assuming that there is one conduction electron per sodium atom, calculate the Fermi energy and Fermi temperature of sodium.

(2) Show that at 3000 K, μ for aluminum differs from μ_0 by less than 0.1% (μ_0=11.7 eV). Note that,

$$\mu = \mu_0 \left\{ 1 - \frac{\pi^2}{12}\left(\frac{kT}{\mu_0}\right)^2 - \frac{\pi^4}{80}\left(\frac{kT}{\mu_0}\right)^4 + \cdots \right\}$$

(3) Given that the energy of an ideal Fermi-Dirac gas is given by $E = E_0\left[1 + \frac{5\pi^2}{12}\eta^2 + \cdots\right]$, where $E_0 = \frac{3}{5}N\mu_0$ and $\eta = \frac{kT}{\mu_0}$, find the contribution of the conductance electrons to the heat capacity in terms of N and the Fermi temperature T_F.