

PHY 491, Homework 6
October 17-22, 2011

Problem 6.1

Calculate the density of states of electron gas in 2 and 1 dimensions. Derive expressions for the Fermi energy in atomic units, where the energy is expressed in Hartree and the length is expressed in Bohr radius. For a 2-d electron gas the density is $1.5 \times 10^{11} \text{ cm}^{-2}$. Express this density in atomic units. What is the Fermi energy for this 2d electron gas?

Problem 6.2

The atom He^3 is a fermion with spin $\frac{1}{2}$ (Why?). The density of He^3 liquid is 0.081 gm/cm^3 near $T=0$. Calculate the Fermi energy ϵ_F and the Fermi temperature T_F .

Problem 6.3

Assuming a free electron gas model for the valence electrons for the following metals, calculate the Fermi energy (in eV) and the zero point pressure (in Atmospheric pressure). Use Table 4 on page 24 of Kittel.

Li, Na, Cs, Cu, Mg, Al, In, Pb