

PHY801: Survey of Atomic and Condensed Matter Physics
Michigan State University

Homework 6

6.1.

- (i) Calculate the density of states of the electron gas in 2 and 1 dimensions.
 - (ii) Derive expressions for the Fermi energy in atomic units, where the energy is expressed in Hartree and the length is expressed in Bohr radius units.
 - (iii) Consider a 2D electron gas with the density of $1.5 \times 10^{11} \text{ cm}^{-2}$. Express this density in atomic units. What is the Fermi energy for this 2D electron gas?
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6.2. The ^3He atom is a fermion with spin $1/2$ (why?). The density of liquid ^3He is 0.081 g/cm^3 near $T = 0$. Calculate the Fermi energy E_F and the Fermi temperature T_F .

6.3. Assuming a free electron gas model for the valence electrons of the metals Li, Na, Cs, Cu, Mg, Al, In, Pb, calculate the Fermi energy (in eV) and the zero point pressure (in atmospheric pressure). Use Table 4 (“*Density and atomic concentration*”) in Chapter 1 of Kittel (p. 24 in 7th edition, p. 21 in 8th edition).
