HW #4

Physics 406

(due 03/04/12)

Reading:

(1) Omar (O) Ch. 4

(2) Handout #4: "a Fermi gas of atoms" by D. Jin

Problems: (↙ question)

1. O. Q. 2
2. O. Q. 6
3. O. Pr. 2 (↑ problem)
4. O. Pr. 6
5. O. Pr. 7
6. Please estimate the ratio of the drift velocity to the Fermi velocity for a 2 mm^2 Cu wire carrying a 20 A current.
7. Derive expression (4.9) for the conductivity in the Drude's model.

8. Liquid He^3. The He^3 atom has spin 1/2 and is a fermion. The density of liquid He^3 is 0.081 g/cm^3 near $T=0$. Calculate the Fermi energy E_F & the Fermi temperature T_F for liquid He^3 near $T=0$.

9. Based on your reading of Handout 4, please describe the challenges associated w/ observing quantum degeneracy in Fermi gases of cold atoms. Please use ≥ 4 sentences in your response.