

Physics 731

HOMEWORK ASSIGNMENT #6

Due: Oct. 23, 2001

Midterm test on Thursday, Nov. 1. You may bring a sheet of paper (8½"×11") that you personally have prepared, with any formulas you want on ONE side.

No classes on Thursday, Oct. 18; make-up Wednesday evening, Oct. 17, 7:15 p.m.

Read about the electron gas: A&M chapters 1, 2, 3. Chap. 3 is short and descriptive.

Problems to turn in (read the rest):

1. A&M 1-5 Argue en route that $\epsilon(\omega_{sp}) = -1$. By the way, surface plasmons were studied first at U. of Maryland, by E.A. Stern and R.A. Ferrell [Phys. Rev. **120**, 130 (1960)].)
2. A&M 2-1 (parts a–e only)
3. A&M 2-3 (parts a–b only)
4. A&M 2-4 (all)
5. Calculate the density of states for a one-dimensional gas of free electrons in a so-called quantum wire with the boundary conditions $\psi(x,y,z) = 0$ for $|x| < a$ and $|y| < b$, where a and b are of atomic dimensions. Assume the one-dimensional density of electrons n is less than $1/2a$ and $1/2b$. (The three-dimensional electronic density of states is then $n/4ab$. Think about what would happen if these inequalities were not satisfied.)

Preview: As noted previously, Prof. H. D. Drew will discuss semiconductors (chaps. 28, perhaps also parts of 29) on Nov. 6 & 8. You will need to have some idea about the concepts of Bloch's theorem, electronic density of states (very similar to phonon density of states--you already read the A&M discussion), energy bands, energy gaps, semiclassical response of electrons to external fields, and effective mass. We will cover the important parts of chap. 8 and bits of chap. 9 and chap. 12, and fill in later what was glossed over.