Department of Physics, University of Maryland, College Park, MD 20742-4111

Physics 731 HOMEWORK ASSIGNMENT #6 Due: Oct. 23, 2007, deadline Oct. 25

Midterm test on Thursday Oct. 18. You may bring a sheet of paper (8½"×11") that you personally have prepared, with any formulas you want on ONE side.

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. NOT ASSIGNED, but read the solution to A&M 1-1, which gives insight into what Drude luckily did not realize.
2. A&M 1-5 Argue en route that $\varepsilon(\omega_{sp}) = -1$. 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)].) This has a lot of algebra but students from previous years found it worthwhile.
3. A&M 2-1 (parts a–e only)
4. A&M 2-2 (parts a–d only)
5. A&M 2-3 (parts a–b only) NOT assigned this year, but you will get the solution.
6. A&M 2-4 (all)
7. a) For low energies ε, calculate the density of states for a one-dimensional gas of free electrons $g(\varepsilon)$ in a so-called quantum wire with the boundary conditions $\psi(x,y,z) = 0$ for $|x| \geq a$ and $|y| \geq b$, where a and b are of atomic dimensions. Low energies imply that $k < \pi/2a, \pi/2b$. (Note that the three-dimensional electronic density is then $n_{1D}/4ab$ and so $g(\varepsilon)$ is $(4ab)^{-1}g_{1D}(\varepsilon)$.) You will want to assume $\Psi(x,y,z) = \phi(x/a)\ \phi(y/b)\ \psi(z)$.

   b) If $b = a$, at what energy do higher states in the x and y directions start to be occupied?