For Wednesday, March 23:

(18) Simulations for Solid State Physics (sss): Use the drude program to explore the classical electron picture. Do exercises 6.7, 22, 23, and 25 from chapter 6 of sss . See the course web page and course Google drive to get at the sss book chapters.

(19) Aluminum is an FCC crystal with a conventional (cubic) lattice constant of 0.405 nm and atomic weight of 27.0 g/mole. Take its valence to be 3, i.e., each atom contributes 3 electrons to the pool of conduction electrons.

Find the number density of (conduction) electrons.

The resistivity of aluminum at room temperature is reported as $2.8 \times 10^{-8}$ Ωm. What’s the scattering time in a Drude picture of conduction?

Using the Sommerfeld model find $k_F$, $v_F$, $E_F$ (in eV), $T_F$.

Find the density of electronic states at the fermi surface (states / eV m$^3$).

Compare the location of the fermi surface to the first Brillouin zone boundary - you can think in terms of the 1st B.Z. boundary for a simple cubic lattice for simplicity. That is, does the fermi surface fall within the 1st zone, intersect the zone boundary at some points, fall outside the 1st zone completely, etc? Provide a sense of relative sizes for these features in $k$-space.

(20) Using the Sommerfeld program in sss, work through exercises 7.2, 7.5, 7.7, 7.8