

Physics 731      HOMEWORK ASSIGNMENT #7      Due: Thursday, Oct. 26, 2006  
Deadline: Tuesday, Oct. 31, 2006

**Midterm on Tuesday, Oct. 24, 2006**

Covers lattices, chemical aspects, phonons, etc.; only electron aspects that are analogous  
Remember that you may bring a crib sheet that you personally prepared; one side of a  
normal sheet of paper (US letter or A4).

Read about Bloch's theorem and the nearly-free electron gas: A&M chapters 8, 9;  
D&G pp. 125-127

**Problems to turn in (read the rest):**

1. 8-1, parts a, e, f, g, h; cf. pp. 168-170 [and figs. 5 & 6] of Kittel's 8<sup>th</sup> (pp. 180-2 in 7<sup>th</sup> pp. 164-6 in 6<sup>th</sup>, 191-2 in 5<sup>th</sup>). Note also the Kronig-Penney model; java applets are listed on the class web-site reference list.
  2. 8-2, parts b & c. [Hint: change k-space variables to ones that have spherical constant-energy contours. Note also part a; this is a more rigorous version of the sloppy sketch in class.] Also, sketch  $g(\epsilon)$  near a minimum (as in part b) and near a saddle point (as in part c).
  3. 9-1
  4. 9-3
  5. a) 9-5a
- 5' (From Kittel 7-1, counts as part of 5 above) *Square lattice, free electron energies.*
- a) Show for a simple square lattice (so in two dimensions) that the kinetic energy of a free electron at a corner of the first zone is higher than that of an electron at the midpoint of a side face of the zone by a factor of 2.
  - b) What is the corresponding factor for a simple cubic lattice (so in three dimensions)?
  - c) What bearing might the result of (b) have on the conductivity of divalent metals?