Prof. Ivan K. Schuller
Physics 211A - Solid State Physics
Fall Quarter 2007

Problem Set 5.

Problem 19.

a)   Show that the equation of motion for a hole is that of a particle of positive
charge e.

b)   Under what approximation is this valid and when will it break down?

Problem 20.

a)   Calculate the donor ionization energies for pentavalent impurities P, As, Sb
in Ge and Si.

b)   Calculate the aceptor ionization energies of trivalent impurities B, A   , Ga
and In in Ge and Si.

c)   Compare these with the experimental values given in Table 28.2, page 580,
Ashcroft and Mermin.

d)   What is the origin of this discrepancy?

Problem 21.

a)   Find the temperature dependence of conductivity for Si, Ge and GaAs.

b)   Use these to calculate the value of the band gap.

c)   Compare this to the values of band gaps quoted in books.

d)   Do they agree, disagree? Why?

Problem 22.

Show that in the relaxation time approximation a one band metal has no
magnetoresistance.