Homework #9 March 5, 2016

Problems (HH= Hook & Hall)

#1 HH 5.5

#2 HH 5.6

#3 Derive carefully Eq 5.49

#4 Derive the relation 5.44 and think about its importance

#5 We wrote down the equation for determining the chemical potential for the most general case in class as

$ne + x_A f(E_A) = nh + x_D + (1-f(E_G-E_D))$

(This is essentially the same as Eq 5.26 + 5.27 + 5.28 rolled into one)

where ne=Ne/V and nh= Nv/V, $x_A = N_A/V$, $x_D = N_D/V$ etc are the densities. Also the book shows in Eqs 5.17 and 5.21 the dependence of Ne and Nv on various parameters.

Calculate the chemical potential numerically for T =0 to T= 1000 K assuming the following values of the parameters. v_0= Unit cell volume = 27 x 10^{-30} /m^3

1) valence electron and hole mass = 1/10 bare electron mass
2) x_A = .05 (5 %)/v_0 i.e. 5 out of 100 cells have an acceptor
3) x_D=.02 (2%)
4) We may assume the band energies (all given in deg K for convenience) E_A =100, E_G= 350 , E_D = 50