2) For each of the following conditions, determine the position of E_{Fi}, compute $E_F - E_{Fi}$, and draw a carefully dimensioned energy band diagram (for instance, use graph paper) for the Si sample. Assume temperature independence for effective mass and use $m_p^* = 0.81m_0$ and $m_n^* = 1.18m_0$. NOTE: E_g (Si) = 1.08 eV at 450 K and 1.015 eV at 650 K. (20 points)

a) T = 300 K, $N_a << N_d$, $N_d = 10^{15}$ cm^{-3}
b) T = 300 K, $N_a = 10^{16}$ cm^{-3}, $N_d << N_a$
c) T = 300 K, $N_a = 9 \times 10^{15}$ cm^{-3}, $N_d = 10^{16}$ cm^{-3}
d) T = 450 K, $N_a = 0$, $N_d = 10^{14}$ cm^{-3}
e) T = 650 K, $N_a = 0$, $N_d = 10^{14}$ cm^{-3}

3) E-Book, problem 4.17 (9 points)

4.17 Silicon at $T = 300$ K is doped with arsenic atoms such that the concentration of electrons is $n_0 = 7 \times 10^{15}$ cm^{-3}. (*a*) Find $E_c - E_F$. (*b*) Determine $E_F - E_v$. (*c*) Calculate p_0. (*d*) Which carrier is the minority carrier? (*e*) Find $E_F - E_{Fi}$.