ECE 340: Quiz #2, V1

Name: Solution

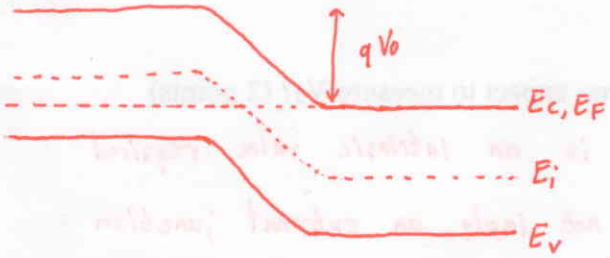
1) Consider a P-N^+ junction shown below:

P	N^+

$N^+ \rightarrow E_c \simeq E_F$

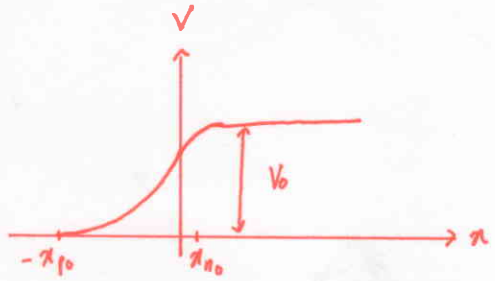
$N_{D,n\text{-side}} > N_{A,p\text{-side}}$

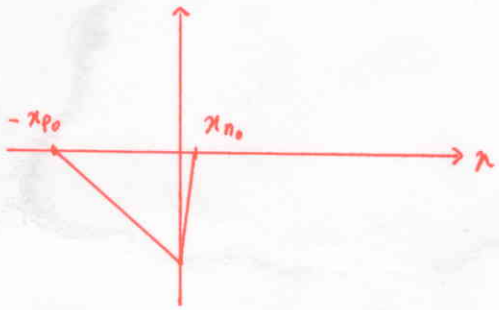
a) Draw the energy band diagram <u>at equilibrium</u> and indicate schematically the position of E_i, E_F, E_c and E_v. (4 points)



b) Sketch the junction potential and electric field. Pay attention to the relative distance scale on each side of the junction. (2 points)

$N_D > N_A \rightarrow x_{p0} > x_{n0}$





c) The space charge region that appears around the metallurgical junction is due to the pileup of electrons and holes on each side of the junction (true or false). (1 point)

False. It is due to a lack of electrons and holes on each side of the junction, creating a space charge of uncompensated donors/acceptors.

d) The built-in voltage V_0 is typically larger than the energy band gap (true or false). (1 point)

False.

e) If you place a voltmeter across this diode, do you expect to measure V_0? (2 points)

No. The built-in potential V_0 is an intrinsic value required to maintain equilibrium and does not imply an external junction potential. New contact potentials will arise upon connecting a voltmeter, cancelling the built-in voltage.