

- 5) A Si wafer is uniformly doped with $2 \times 10^{17} \text{ cm}^{-3}$ of Phosphorous and $4 \times 10^{17} \text{ cm}^{-3}$ of Boron. Assuming full ionization, calculate the following quantities at room temperature ($T = 300 \text{ K}$).
- The equilibrium hole concentration, p . (start with the charge-neutrality condition).
 - The equilibrium electron concentration, n .
 - The position of the Fermi level (E_F) relative to the intrinsic level (E_i). Draw the band diagram show these to levels.
 - Which one of the two quantities p or n has the strongest temperature dependence near 300 K? Explain.
 - Suppose you now add $1 \times 10^{13} \text{ cm}^{-3}$ of Arsenic to the Si sample. What will be the equilibrium concentration of holes (p) at 300K? (Don't have to go through the whole math again. Make an educated guess with justification).