

ECSE-2210 Microelectronics Technology
Fall 2005
Class Activity 8

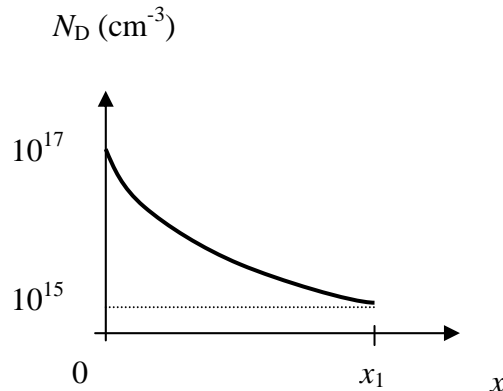
1. Name three generation and three recombination processes. Which one is more common in Si and Ge? Which one is more common in GaAs?

2. Explain what “direct band-gap” and “indirect band-gap” semiconductor mean. (One sentence each)

3. An n-type silicon sample is doped such that the doping concentration decreases exponentially from 10^{17} cm^{-3} to 10^{15} cm^{-3} as x increases from zero to x_1 (see the figure below). The sample is in thermal equilibrium. The magnitude of the electric field inside Si between $x = 0$ to $x = x_1$ is: (Choose one). Explain your choice.
 - (a) linearly decreasing
 - (b) linearly increasing
 - (c) constant
 - (e) exponentially decreasing
 - (f) zero

and

the direction of \mathcal{E} -field is in the
(positive x , negative x : choose one) direction.



4. In question 4, indicate the direction of the electron diffusion current density, and electron drift current density. What is the sum of these two currents? Explain.

5. In question 4, indicate the direction of hole drift current density and hole diffusion current density. What is the sum of these two currents? Explain.

6. The electron mobility in an n-type Si sample is $1200 \text{ cm}^2/\text{Vs}$. Calculate the electron diffusion coefficient in cm^2/s .

7. Show that $D_n/\mu_n = kT/q$.