CHE323/384 Chemical Processes for Micro- and Nanofabrication
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Homework #1

1. For dopant atoms uniformly distributed in a silicon crystal, how far apart are these dopant atoms when the doping concentration is a) 2×10^{15} cm^{-3}, b) 10^{18} cm^{-3}, c) 7×10^{20} cm^{-3}.

2. What is the resistivity of pure silicon at room temperature?

3. a) Show that the minimum conductivity of a semiconductor occurs when $n = n_i\sqrt{\mu_p/\mu_n}$. b) How does the minimum conductivity for silicon compare to the intrinsic conductivity of silicon at room temperature?

4. Consider a resistor made of pure silicon with a cross-sectional area of 0.5 μm^2, and a length of 50 μm. What is the resistance of this silicon piece? For an applied voltage of 5 V, how much current would flow through it?

5. Suppose the resistor of problem 4 were made of p-type silicon. What doping level would be required to make the resistance equal to 25 kΩ? 25Ω?