

Calculate the resistance of a rectangular bar resistor with dimensions: $L = 20 \mu\text{m}$, $W = 5 \mu\text{m}$, and $t = 0.5 \mu\text{m}$, if the bar is made out of the following materials:

- intrinsic silicon: $R =$ _____ (This is a big value!)
- n -doped silicon ($n = N_D = 5 \times 10^{16} \text{ cm}^{-3}$): $R =$ _____
- n -doped silicon ($n = N_D = 5 \times 10^{18} \text{ cm}^{-3}$): $R =$ _____
- p -doped silicon ($p = N_A = 5 \times 10^{16} \text{ cm}^{-3}$): $R =$ _____
- aluminum ($\rho = 2.8 \mu\Omega\cdot\text{cm}$): $R =$ _____

Use mobility data from the graph (or equation) given in the notes. Recall that intrinsic silicon has electrons and holes in equal concentration: $n = p = 6 \times 10^9 \text{ cm}^{-3}$ at room temp. Assume everything else is at room temperature as well.