Name:_____

Student ID #:_____

EECS 170A Section B

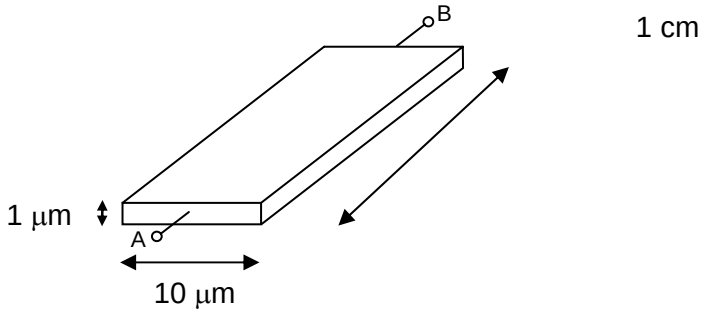
Homework #2

HW will be collected in DISCUSSION ONLY.
Do not turn your HW in anywhere else, or it will not be accepted.
You are encouraged to turn it in at your own discussion section.
You may turn it in at any discussion section.
Last option to turn in: Right after Friday discussion section October 20, 2006.
DUE: 10 AM Friday, October 20, 2006.

Please *staple* this sheet to the front of your homework.

1	2	3a	3b	3c	3d	4a	4b	Total
/20	/20	/10	/10	/10	/10	/10	/10	/100

1) Pure, bulk copper (Cu) has a resistivity (ρ) of 1.7 μΩ-cm. Imagine you wanted to jump start you car. The battery of your friends car is 12 V, and so is your battery when connected. When the car is off, no current is flowing anywhere. When you first start the car, your friend's battery will (briefly) source about 10 A in order to get the (your) motor to start up. This will cause an I R voltage drop along the wires between his car and your car. How thick must the wires be so that the IR voltage drop is much less than the 12 V of his battery? The wires are made of copper, and assume they are 10 feet long.
2) A thin metal wire as shown in the figure below is made of copper. It is 1 cm long, 10 μm wide, and 1 μm thick. Calculate the resistance.



3) For Si at 300 K, do the following: (Use cm^{-3} as your units.)
   a. $N_D = 10^{18}$ cm^{-3}; $N_A = 10^{12}$ cm^{-3}.
      Calculate the equilibrium electron concentration (n) and hole concentration (p).
   b. $N_A = 10^{18}$ cm^{-3}; $N_D = 10^{12}$ cm^{-3}.
      Calculate the equilibrium electron concentration (n) and hole concentration (p).
   c. $N_A = 10^{18}$ cm^{-3}; $N_D = 10^{18}$ cm^{-3}.
      Calculate the equilibrium electron concentration (n) and hole concentration (p).
   d. $N_A = 10^{12}$ cm^{-3}; $N_D = 10^{12}$ cm^{-3}.
      Calculate the equilibrium electron concentration (n) and hole concentration (p).

4) For the silicon sample at T= 300 K shown below, it is desired to have a resistance of 1 kΩ.
   a. If it is n-doped, find the required doping concentration.
   b. If it is p-doped, find the required doping concentration.