Name:_____

Student ID #:_____

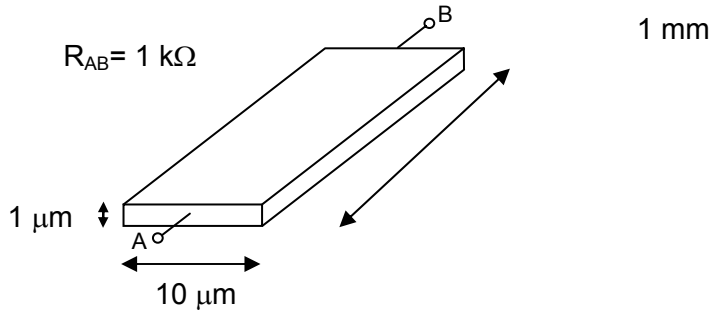
EECS 170A Section B
Homework #2

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 Wednesday discussion section October 19, 2005.
DUE: 1 PM Wednesday, October 19, 2005.

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

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

1) In modern integrated circuits, copper is used as the interconnect material. Ideally, the interconnect wiring would have zero resistance. In this exercise, we will see how low the resistance really is. Calculate the resistance of a typical copper trace. Assume the dimension is 0.1 μm wide, 0.1 μm high, and 1 cm long. Pure, bulk copper (Cu) has a resistivity (ρ) of 1.7 μΩ-cm.
2) A thin metal film resistor as shown in the figure below has a resistance of 1 kΩ. It is 1 mm long, 10 μm wide, and 1 μm thick.
   a. Calculate the resistivity (ρ), in units of Ω-m.
   b. Now express the resistivity in units of μΩ-cm, a more common unit.



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

4) For the silicon sample at T= 300 K shown below, given $N_A = 10^{20}$ cm^{-3}, $N_D << N_A$,
   a. Find the resistivity ρ of the Si to within 10%. For units, use Ω-cm.
      (You may use figure 3.8 from the text.)
   b. Calculate the resistance R_{AB} in units of Ω, for the following geometry: