EECS277C Spring 11 **Final Exam** Name:____________

6/6/2011 4:00 to 6:00 pm ID no.:____________

Professor Peter Burke

(3) [40 pts.] Consider a metallic single walled carbon nanotube at room temperature. Fill in the following table:

Item	
Long nanotube (L= 1 cm): Ballistic or diffusive transport?	D
Approximate resistance? (Assuming perfect contacts?)	6×10^4 kΩ = 60 MΩ
Short nanotube (L= 0.1 micron): Ballistic or diffusive transport?	B
Approximate resistance? (Assuming perfect contacts?)	6 kΩ

4) [10 pts.] Which metal would you pick for a low resistance contact to n-type charge carriers in a semiconducting carbon nanotube: Large work function, or small work function?

Small

5) [10 pts.] In class we had a demonstration tunnel junction with two Al electrodes separated by a thin oxide tunnel barrier. Imagine you had a very short carbon nanotube (length 0.1 microns) with an oxide barrier between the contact and the end of the nanotube on both sides, with the same tunneling probability that we calculated in HW1 for the Al tunnel barrier. (Recall on the HW1 we found that to be $T=10^{-10}$).

A) Estimate the low bias resistance of this system at high temperatures.

$(10^{+10})^2 \times 6\,k\Omega$

B) As the temperature decreases, does that resistance change, and why?

$\downarrow$ MFP $\downarrow$

$\uparrow$ SET becomes important

either answer could be correct