Week 7 Lecture 16-L17 Quiz:
Resistance: Ballistic to Diffusive

ECE 656: Electronic Conduction In Semiconductors

Mark Lundstrom
Purdue University, Fall 2013

Student's name: _____

Answer the **multiple choice questions** below by choosing the **one, best answer**. Then **ask a question** about the lecture.

1) The expression for the ballistic conductance, $G_{ball} = \frac{2q^2}{h} M\left(E_F\right)$ is valid when?

   a) In the degenerate limit.
   b) For 1D and 2D conductors.
   c) For isothermal conditions.
   d) For ballistic conductors.
   e) All of the above.

2) In general, we can write the ballistic conductance as $G_{ball} = \frac{2q^2}{h}\langle M \rangle$. What is $\langle M \rangle$?

   a) The number of channels.
   b) The number of channels at the Fermi energy.
   c) The average number of channel in the Fermi window.
   d) The number of channels at the bottom of the conduction band.
   e) The total number of channels in the Fermi window.

3) The expression for the resistance, $R = R_{\text{ball}}\left(1 + L/\lambda_0\right)$ is **not valid** under what conductions?

   a) In the ballistic limit.
   b) In the diffusive limit.
   c) In between the ballistic and diffusive limits.
   d) When the mean-free-path depends on energy.
   e) Under non-degenerate conductions.

continued on next page

4) For a ballistic resistor, the power dissipated is $P_D = IV = V^2/R$. Where is this power dissipated?

a) Uniformly within the resistor.
b) Near the two ends of the resistor.
c) In the contact with the most positive voltage.
d) In the contact with the most negative voltage.
e) In the two contacts.

5) For a ballistic resistor, with a voltage, *V*, applied across it, where does the voltage drop?

a) Uniformly within the resistor.
b) Near the two ends of the resistor.
c) In the contact with the most positive voltage.
d) In the contact with the most negative voltage.
e) In the two contacts.

6) What question do you have about this lecture?

Turn in to Prof. Lundstrom in class on Friday.