

NANO 705

Quiz 1

Please indicate answers by clearly circling the letter of your selection.

1) The conducting region connecting the source and drain in a field-effect nanotransistor is called:

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|------------|------------|---------|
| a) contact | b) tunnel | c) bias |
| d) chunnel | e) channel | f) gate |
| g) oxide | h) chain | |
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2) The condition in which no current flows is called:

- | | | |
|---------------------|-----------------------|-----------------|
| a) steady state | b) chemical potential | c) single level |
| d) detailed balance | e) transmission | f) equilibrium |
| g) inversion | h) self-consistent | |
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3) A discrete electron energy level has degeneracy (# of states) $N_\epsilon = 100$ and energy ϵ positioned above the chemical potential μ by $\epsilon - \mu = 0.050$ eV. Find the average number of filled states. (Use $kT = 0.025$ eV):

- | | | |
|---------|---------|---------|
| a) 99.9 | b) 15.7 | c) 25.0 |
| d) 11.9 | e) 113 | f) 13.5 |
| g) -2.1 | h) 46.2 | |
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4) Identify the following statements as true or false (T/F).

- _____ Transistors are *three*-terminal electronic devices.
- _____ If an energy level lies *above* the chemical potential, the level is predominately *empty*.
- _____ The broadening of the density of states in a nanostructure does *not* depend on the strength of coupling to the source and drain.
- _____ There is a quantum-mechanical upper limit for the conductance of a single-level nanostructure.
- _____ Fortunately, the equations describing the electrostatic potential energy in the nanostructure and charge transport through the nanostructure are independent — they do not require a self-consistent solution.
- _____ The eigenvalues of the time-independent Schrodinger equation give the allowed energies for quantum-mechanical states in a system.