Assignment 1

The due date for submitting this assignment has passed.

As per our records you have not submitted this assignment.

Due on 2021-02-03, 23:09 IST.

1) Scaling limit of MOSFET can be improved by
   • Increasing the depletion constant of the gate oxide
   • Increasing depletion constant of the channel material
   • Increasing the thickness of the gate oxide
   All of these
   No, the answer is incorrect. Score: 0
   Accepted Answers:
   • Increasing the depletion constant of the gate oxide

2) For unaccomplished electronic transport through a conductor
   • The distribution will have a non-zero skewness
   • There will be shot-noise suppression
   • The distribution will be Poissonian
   • None of these
   No, the answer is incorrect. Score: 0
   Accepted Answers:
   • The distribution will be Poissonian

3) The density of states in 3D solids
   • Proportional to the energy
   • Proportional to square-root of carrier concentration
   • Independent of energy
   • Proportional to square-root of energy
   No, the answer is incorrect. Score: 0
   Accepted Answers:
   • Proportional to square-root of energy

4) Full width at half-maximum of Fermi distribution is
   • Proportional to the temperature
   • Inversely proportional to the temperature
   • Independent of energy
   • Proportional to the square-root of temperature
   No, the answer is incorrect. Score: 0
   Accepted Answers:
   • Proportional to the temperature

5) Phase-relaxation length, \( \xi \)
   • \( \xi \approx \sqrt{r} \), for elastic scattering length
   • \( \xi \approx \sqrt{r} \), for inelastic scattering length
   • \( \xi \approx r_{\text{atom}} \), the inelastic scattering length
   • All of these
   No, the answer is incorrect. Score: 0
   Accepted Answers:
   • All of these

6) Consider two solids, A & B, with carrier densities \( n_A > n_B \)
   • A has larger elastic mean-free-path
   • B has larger elastic mean-free-path
   • None of these
   No, the answer is incorrect. Score: 0
   Accepted Answers:
   • B has larger elastic mean-free-path

7) Density of states (DOS) plays a major role in the electronic transport. Given that the DOS in 3D solid has an energy dependence, why does the resistance of a 2D solid is independent of the applied voltage and remains constant?
   • The voltage window of the applied voltage is small
   • Voltage does not change the density of states
   • The density of states does not affect the resistance
   • All of these
   No, the answer is incorrect. Score: 0
   Accepted Answers:
   • All of these

8) Which of the following is false according to Fano’s law?
   • The number of transistors in a chip doubles roughly every two years
   • The performance of a computer chip roughly doubles every 18 months
   • The minimum dimension in a transistor cannot be less than 7 nm
   • The cost per component is roughly inversely proportional to the number of components
   No, the answer is incorrect. Score: 0
   Accepted Answers:
   • The number of transistors in a chip doubles roughly every two years

9) As per Brilliouin theory of electrical transport, what is the temperature dependence of resistance for metals?
   • Does not depend on temperature
   • Proportional to \( T \)
   • Inversely proportional to \( T \)
   • Proportional to \( T^2 \)
   No, the answer is incorrect. Score: 0
   Accepted Answers:
   • Proportional to \( T \)

10) Can we observe singleelectron charging phenomena in a 100 \( \mu \)m-thick silicon diode? Explain.
    • Yes, always
    • No, only at very low temperatures
    • Yes, only at very high temperatures
    • Yes, depending on the material
    No, the answer is incorrect. Score: 0
    Accepted Answers:
    • No, only at practically achievable temperatures