Week 2 - assignment

The due date for submitting this assignment has passed. As per our records you have not submitted this assignment. Due on 2019-02-13, 23:59 IST.

1) Calculate the electron concentration in Silicon at T = 300K. Given that Fermi energy is 0.25 eV below the conduction band. Assume that the system is in thermal equilibrium. \( N_c = 2.8 \times 10^{19}/\text{cm}^3 \), \( N_v = 1.04 \times 10^{19}/\text{cm}^3 \), \( n_i = 1.5 \times 10^{10}/\text{cm}^3 \).

- 1.8x10^15/cm^3
- 5x10^14/cm^3
- 8x10^16/cm^3
- 1.0x10^17/cm^3

No, the answer is incorrect.
Score: 0
Accepted Answers:
1.8x10^15/cm^3

2) Calculate the position of the intrinsic Fermi Level with respect to the middle of the band gap in Silicon at T = 300 K. Assume that \( m_n^* = 1.08 \text{ mo} \) and \( m_p^* = 0.56 \text{ mo} \).

- 10 meV below the mid energy
- 12.8 mev below the mid energy
- 10 meV above the mid energy
- 15 meV above the mid energy

No, the answer is incorrect.
Score: 0
Accepted Answers:
12.8 mev below the mid energy

3) Calculate intrinsic Fermi level (\( E_{FI} \)) in Silicon at T = 200 K, with respect to the middle of the band gap.
Efi - E mid band energy = - 0.112 (kT)

No, the answer is incorrect.
Score: 0
Accepted Answers:
Efi - E mid band energy = - 0.495 (kT)

4) A semiconductor is doped with n-type dopant of 2X10^16/cm^3 and p-type dopant of 1X10^16/cm^3. The concentration of electrons in the semiconductor is approximately..? (assume ni = 1X10^16/cm^3)

- 1.62 X 10^16/cm^3
- 2 X 10^17/cm^3
- 10^18/cm^3
- None of the above

No, the answer is incorrect.
Score: 0
Accepted Answers:
1.62 X 10^16/cm^3

5) If the concentration of electrons in a semiconductor material is equal to the conduction band density of states, then the location of Fermi-level above the conduction band at T= 300 K is approximately (neglect band-gap narrowing) (assume k = 8.52X10^-5eV/K)

- 0 eV
- 9 meV
- 26 meV
- 50 meV

No, the answer is incorrect.
Score: 0
Accepted Answers:
9 meV

6) If acceptor level in a semiconductor is above the Fermi level by 2kT, the fraction of ionized acceptors is approximately.? 

- 33%
- 58%
- 3%
- 90%

No, the answer is incorrect.
Score: 0
Accepted Answers:
3%

7) Consider a piece of silicon (X) doped with both donor and acceptor impurities as: ND = 2 X 10^17/cm^3 and NA = 10^17/cm^3. Another piece of Silicon (Y) is doped with only donors ND = 10^17/cm^3. Assume complete ionization of impurities. Which of the following statement is true.

- Electron concentration in sample X > sample Y
- Electron concentration in sample X < sample Y
- Electron concentration in sample X is approximately equal to sample Y

No, the answer is incorrect.
Score: 0
Accepted Answers:
Electron concentration in sample X > sample Y
8) Two semiconductor materials have exactly the same properties except that material A has a band gap energy of 1.0 eV and material B has a band gap energy of 1.2 eV. Determine the ratio of $n_i$ of material A to that of material B at $T = 300 \, \text{K}$.

- 25.2
- 39.2
- 47.5
- 56.5

No, the answer is incorrect.
Score: 0

Accepted Answers:
Electron concentration in sample X is approximately equal to sample Y