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Courses » Fundamentals of semiconductor devices

Announcements **Course** Ask a Question Progress FAQ

Unit 3 - Equilibrium carrier concentration

Register for Certification exam

Course outline

How to access the portal

Basics of semiconductor physics

Equilibrium carrier concentration

- Doping and intrinsic carrier concentration
- Equilibrium carrier concentration
- Temperature dependence of carrier concentration
- High doping effects and incomplete ionization
- Quiz : Week 2 - assignment
- Week 2 assignment solution

Carrier transport

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. (Nc = 2.8 × 10^19/ cm3, Nv = 1.04 × 10^19/ cm3, ni = 1.5 × 10^10/ cm3). ***1 point***

- 1.8x10^15/cm3
- 5x10^14/cm3
- 8x10^16/cm3
- 1.0x10^17/cm3

No, the answer is incorrect.
Score: 0

Accepted Answers:
1.8x10^15/cm3

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 mn* = 1.08 mo and mp* = 0.56 mo. ***1 point***

- 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 (EFi) in Silicon at T = 200 K, with respect to the middle of the band gap. ***1 point***

semiconductor junction

Bipolar Junction Transistor

Metal Oxide Semiconductor Capacitor

MOSFET

Interaction session

DOWNLOAD VIDEO

Text Transcripts

Compound Semiconductors

Opto-electronic devices: Solar cells and photo-detectors

Opto-electronic devices: Light Emitting Diodes (LED)

Applications of transistors and basics of microelectronic fabrication

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/cm3 and p-type dopant of 10^16/cm3. The concentration of electrons in the semiconductor is approximately..? (assume ni = 10^16/cm3) ***1 point***

- 1.62 X 10^16/cm3
- 2 X 10^17/cm3
- 10^18 /cm3
- None of the above

No, the answer is incorrect.
Score: 0

Accepted Answers:
1.62 X 10^16/cm3

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) ***1 point***

- 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.? ***1 point***

- 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/cm3 and NA = 10^17/cm3. Another piece of Silicon (Y) is doped with only donors ND = 10^17/cm3. Assume complete ionization of impurities. Which of the following statement is true. ***2 points***

- 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

Additional information is needed

No, the answer is incorrect.
Score: 0

Accepted Answers:
Electron concentration in sample X is approximately equal to 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 ***2 points*** of material A to that of material B at T = 300 K.

- 25.2
- 39.2
- 47.5
- 56.5

No, the answer is incorrect.
Score: 0

Accepted Answers:
47.5

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