Physics of Materials and Nuclei - MidSem

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Semiconductor Physics

If the concentration ratio of conduction electrons and holes in a semiconductor with zero Hall coefficient is 16, estimate the ratio of mobilities of the conduction electron and holes. 1 point

- ○ 1:4
- ○ 4:1
- ◉ 1:16
- ○ 1:2

Clear selection

Which of the following(s) is/are true for metals? 1 point

- ☑ conduction is due to drift current
- ☑ they obey Ohm's law
- ☑ they exhibit high thermal and electrical conductivities
- ☐ conduction is due to diffusion current

For a given semiconductor, the product of electron and hole concentration changes with _____. 1 point

- [ ] pressure
- [ ] All of the above
- [ ] doping concentartion
- [x] temperature

Copper has a face-centered cubic lattice with interatomic spacing equal to 0.254 nm. Estimate the Hall coefficient for copper by considering each Cu atom contributes one valence electron. 2 points

- ( ) +7.25 x 10^-11 m^3/C
- ( ) -0.245 x 10^-9 m^3/C
- (•) -7.25 x 10^-11 m^3/C
- ( ) +0.245 x 10^-9 m^3/C

Clear selection

At 400K, find the position of intrinsic Fermi level with respect to the mid of the gap if the effective masses of electron and holes are 1.12 and 0.56 times of the rest mass of the electron, respectively. 1 point

- ( ) 17.9 meV below the mid gap
- (•) 23.8 meV below the mid gap
- ( ) 17.9 meV above the mid gap
- ( ) 23.8 meV above the mid gap

Clear selection

Which of the following(s) is/are true about direct bandgap semiconductors? 1 point

- [ ] Silicon is a well known example of this type.
- [x] an electron and a photon are involved in this process.
- [x] are useful in the preparation of optical devices (LEDs and semiconductor lasers).
- [ ] law of mass action can not be applicable.

Which of the following statement(s) is/are true? 1 point

- [ ] Each donor atom contributes two free electrons to the semiconducting crystal lattice.
- [x] Mobility of charge carriers equals its drift velocity divided by the applied electric field.
- [x] A substitution impurity in donor and acceptor atoms does not cause any disturbances in the crystal lattice of semiconducting material.
- [x] In an n-type semiconductor, the free electrons concentration approximately equals the density of donor atoms.