Rajiv Gandhi University of Knowledge Technologies

Weekly Test 5- Semiconductor Devices

Date: 22.09.2012 **Time:** 30 Min

Course: E2Sem1_ ECE /others **Max Marks:** 10

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1. Which of the following semiconductor is not a direct band gap semiconductor?

a) ZnSe
b) AlAs
c) GaN
d) GaAs
e) ZnO
f) CdS
g) InP
h) None of these

2. Which of the following is not an indirect band gap semiconductor?

a) GaP
b) AlAs
c) GaN
d) SiC
e) AlP
f) Si
g) Ge
h) None of these

3. A semiconductor conductor in thermal equilibrium, has a hole concentration of 10^{16} cm^{-3} and an intrinsic concentration of 10^{10} cm^{-3} .The minority carrier lifetime is 2×10^{-7} sec. What is the thermal-equilibrium recombination rate of electrons?

a) 8×10^{17} / cm^3 sec
b) 5.7×10^{12} / cm^3 sec
c) 5.0×10^{10} / cm^3 sec
d) 3.8×10^{13} / cm^3 sec
e) 7.3×10^{11} / cm^3 sec
f) 1.4×10^{14} / cm^3 sec
g) 2.0×10^{19} / cm^3 sec
h) None of these

4. For the above problem what is the change in the recombination rate of electrons if an excess electron concentration of $10^{12}\ cm^{-3}$ exists.

a) 8.8×10^{12} / cm^3 sec
b) 1.7×10^{16} / cm^3 sec
c) 5.8×10^{10} / cm^3 sec
d) 3.5×10^{17} / cm^3 sec
e) 5.0×10^{18} / cm^3 sec
f) 1.7×10^{14} / cm^3 sec
g) 3.0×10^{21} / cm^3 sec
h) None of these

5. What is the time required for the excess conductivity to drop 10 % of its value at t = 0 in a semiconductor assume $\tau_n = 1\mu$sec.

a) 2.3×10^{-6} sec
b) 4.6×10^{-7} sec
c) 5.3×10^{-1} sec
d) 2.9×10^{-5} sec
e) 7.3×10^{-3} sec
f) 9.3×10^{-8} sec
g) 1.3×10^{-9} sec
h) None of these

6. Identify the completely wrong statements set for the recombination processes?

A: τ is inversely proportional to density of traps

B: τ is proportional to density of traps

C: τ is smaller at the surface than in bulk

D: τ is greater at the surface than in bulk

E: recombination through defects is much often probable than the direct recombination

F: recombination through defects is not probable than the direct recombination process.

a) A , D & E
b) A , C & E
c) A , C & F
d) D , B & E
e) B , D & F
f) A , D & F
g) A & C ONLY
h) B & F ONLY

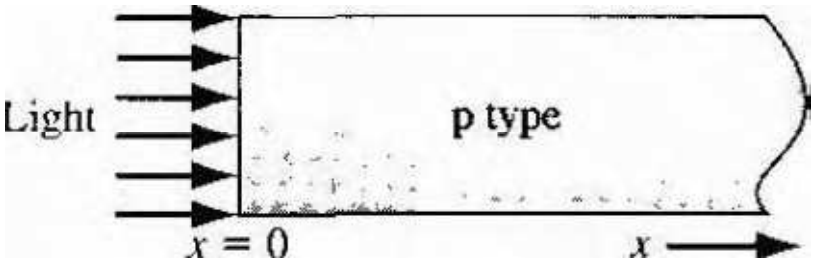
7. A Si sample is doped uniformly with 10^{15} donors per cm^3 and has τ_p =1μsec .What is the photo generation rate that will produce 2 x 10^{13} excess pairs per cm^3 in the steady state?

a) 2.8 x 10^{16} / cm^3
b) 4.6 x 10^{18} / cm^3
c) 5.3 x 10^{14} / cm^3
d) 2.9 x 10^{13} / cm^3
e) 7.3 x 10^{11} / cm^3
f) 9.3 x 10^{17} / cm^3
g) 2.0 x 10^{19} / cm^3
h) None of these

8. For the above problem what is the conductivity of the sample is (assume μ_n =1325 cm^2/v-s, μ_p= 450 cm^2/v-s and n_i =1.5 x 10^{10} cm^{-3})

a) 0.218 $(ohm\text{-}cm)^{-1}$
b) 4.838 $(ohm\text{-}cm)^{-1}$
c) 5.219 $(ohm\text{-}cm)^{-1}$
d) 9.618 $(ohm\text{-}cm)^{-1}$
e) 8.278 $(ohm\text{-}cm)^{-1}$
f) 0.708 $(ohm\text{-}cm)^{-1}$
g) 0.998 $(ohm\text{-}cm)^{-1}$
h) None of these

9. In a p- type Si, excess carriers are being generated at the end of the semiconductor bar at x=0 as shown in figure. The doping concentration is N_a= 5 x 10^{16} cm^{-3} and N_d =0 .The steady state excess carrier concentration at x= 0 is $10^{15}cm^{-3}$. The applied electric field is Zero.Asssume that τ_n =8 x 10^{-7} sec. what is the diffusion length for the minority charge carriers (μ_n =1050 cm^2/v-s)



a) 46.6 µm
b) 59.8 µm
c) 36.0 µm
d) 15.6 µm
e) 76.6 µm
f) 89.1 µm
g) 99.9 µm
h) 9.00 µm

10. For the above problem what is the electron diffusion current density at diffusion length

a) -.146 A/cm^2
b) -.917 A/cm^2
c) -.614 A/cm^2
d) -.295 A/cm^2
e) -.389 A/cm^2
f) -.344 A/cm^2
g) -.741 A/cm^2
h) -.044 A/cm^2

Key

1.b

2.c

3.c

4.e

5.a

6. e

7. h

8. a

9. a

10.f