**Test for Drift-Diffusion Lab**

**(**<http://nanohub.org/tools/semi>)

Note: only one choice is correct

1. What is the formula for net current (*J*) in a semiconductor?
	1. $J=qμ\_{p}pE-qD\_{p}∇p+qμ\_{n}nE+qD\_{n}∇n$
	2. $J=qμ\_{p}pE-qD\_{p}∇p+qμ\_{n}nE-qD\_{n}∇n$
	3. $J=-qμ\_{p}pE-qD\_{p}∇p+qμ\_{n}nE+qD\_{n}∇n$
2. What can be the transport mechanism if gradient in Fermi energy is zero?
	1. Drift
	2. Diffusion
	3. both
3. If ***D*** is diffusion coefficient and ***µ*** is mobility, what is ***D/µ*** ?
	1. 1
	2. *kT/q*
	3. q/kT
4. How do mobility and conductivity change with increasing doping?
	1. mobility decreases and conductivity increases
	2. mobility increases and conductivity decreases
	3. mobility decreases and conductivity decreases
5. Which material has highest electron mobility
	1. Si
	2. Ge
	3. GaAs
6. A semiconductor bar has uniform generation rate of 1016/cm3.s (Assume no surface recombination). Carrier recombination time τ =10-6s and the bar is doped n-type 1015/cm3. What are the steady state n and p carrier concentrations? Does low level injection condition prevail?
	1. n=1015/cm3 p=1010/cm3 ; YES
	2. n=1015/cm3 p=109/cm3 ; YES
	3. n=1015/cm3 p=105/cm3 ; NO
7. Electron mobility in a material is µn=16,000 cm2/V-s and mn=0.1mo. What is the average time between collisions?
	1. 0.91 ns
	2. 0.91 ps
	3. 9.1 ps
8. A material has electron drift velocity, $v\_{100}=2×10^{3} cm/s$. The material has mn(100)=0.1m0 and mn(110)=0.4m0.What is ***µxy***if *Exy*= 2 V/cm.
	1. 500 cm2/V-s
	2. 1,000 cm2/V-s
	3. 1,500 cm2/V-s
9. How does resistivity of a material vary with increasing temperature?
	1. doesn’t change
	2. decreases
	3. Increases
10. A long semiconductor bar has light shining at the center (x=0). Surface recombination is 0 on right edge while it is $\infty $ on the left edge. How will minority carrier concentration vary if low level injection prevails?
11. A long Silicon (Si) bar, n-type doped at ND=1015/cm3 is illuminated at left edge so as to create Δ*p*(x=0) =1010/cm3. At what x will Δ*p*(x) reduce to half of Δ*p*(x=0). Assume Si µn=1400 cm2/V.s, µp=450 cm2/V.s, τn =1 µs, τp =1 µs and T=300K.
	1. 41.65 µm
	2. 147.02 µm
	3. 23.61 µm
12. Which of the following represents an indirect bandgap?
	1.
13. At t=0s the electron (n) and hole (p) carrier profile in a semiconductor looks like as in figure below. Carrier density vary linearly over the length of 1µm and n0= p0=1014/cm3. What is the diffusion current at t=0s. (µn=1400 cm2/V.s, µp=450 cm2/V.s).
	1. -7.63 A/m2
	2. 7.63 A/m2
	3. -3.92 A/m2
14. Center of a long intrinsic semiconductor bar is illuminated, leading to generation of excess carriers. No bias is applied .What would best represent the band diagram at the center? [FN (blue)=Electron quasi Fermi level; FP(red)=Hole quasi Fermi level]
15. What process is necessary for band to band recombination in an indirect semiconductor besides emission of photon?
	1. Scattering by an impurity
	2. Change in bandgap
	3. Emission or Absorption of phonon