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Courses » Fundamentals of semiconductor devices

Announcements **Course** Ask a Question Progress FAQ

Unit 4 - Carrier transport

Register for
Certification exam

Course outline

How to access
the portal

Basics of
semiconductor
physics

Equilibrium
carrier
concentration

Carrier transport

- Carrier scattering and mobility
- Low-field and High-field transport, Introduction to Diffusion
- Drift-diffusion and Trap statistics
- Current continuity equation
- Continuity equation (contd.) and Introduction to p-n junction

Week3_Assignment

The due date for submitting this assignment has passed.

As per our records you have not submitted this assignment. **Due on 2019-02-20, 23:59 IST.**

1) As the electric field increases, the velocity of electrons travelling in the semiconductor increases. Which of the following statement is true when electron velocity is below the saturation velocity? **1 point**

- Mobility of electrons increases with increase in electric field across material
- Mobility of electrons decreases with increase in electric field across material
- Mobility of electrons remains same with electric field across material
- Concept of mobility is not valid when electron travels with velocity below saturation velocity

No, the answer is incorrect.

Score: 0

Accepted Answers:

Mobility of electrons remains same with electric field across material

2) The E-k diagram for conduction band of material A is narrower or sharper than that of material B. The relation between electron mobilities in material A and B is **1 point**

- Mobility of electrons in material A < material B
- Mobility of electrons in material A > material B
- Mobility of electrons in material A = material B
-

More information is needed

No, the answer is incorrect.

Score: 0

Accepted Answers:

Mobility of electrons in material A > material B

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p-n junction	ce De	<input type="radio"/> Increases, increases
Applications of p-n junctions and details of metal-semiconductor junction		<p>No, the answer is incorrect. Score: 0 Accepted Answers: <i>Increases, decreases</i></p>
Bipolar Junction Transistor		<p>4) If the total mobility of electrons in a semiconductor material is $2000 \text{ cm}^2/\text{V}\cdot\text{s}$ and the ionized impurity limited mobility is $10000 \text{ cm}^2/\text{V}\cdot\text{s}$, then phonon limited mobility is 1 point</p> <p> <input type="radio"/> $500 \text{ cm}^2/\text{V}\cdot\text{s}$ <input type="radio"/> $5000 \text{ cm}^2/\text{V}\cdot\text{s}$ <input type="radio"/> $6000 \text{ cm}^2/\text{V}\cdot\text{s}$ <input type="radio"/> $2500 \text{ cm}^2/\text{V}\cdot\text{s}$ </p>
Metal Oxide Semiconductor Capacitor		<p>No, the answer is incorrect. Score: 0 Accepted Answers: <i>$2500 \text{ cm}^2/\text{V}\cdot\text{s}$</i></p>
MOSFET		<p>5) Calculate the mean scattering time of an electron having mobility of $3000 \text{ cm}^2/\text{V}\cdot\text{s}$ at 300 K. Assume effective mass as $m_n = 0.3 m_0$. 1 point</p> <p> <input type="radio"/> 15 s <input type="radio"/> 10 ms <input type="radio"/> 0.5 ps <input type="radio"/> 1 us </p>
Interaction session		<p>No, the answer is incorrect. Score: 0 Accepted Answers: <i>0.5 ps</i></p>
DOWNLOAD VIDEO		<p>6) In an n-type semiconductor, electron concentration varies linearly from 5×10^{19} to $2 \times 10^{16} \text{ cm}^{-3}$ over 1 cm. Calculate the diffusion current density at 300 K? Assume $D_n = 30 \text{ cm}^2/\text{s}$. 1 point</p> <p> <input type="radio"/> 240 A/cm^2 <input type="radio"/> 1 A/cm^2 <input type="radio"/> 24 A/cm^2 <input type="radio"/> 10 A/cm^2 </p>
Text Transcripts		<p>No, the answer is incorrect. Score: 0 Accepted Answers: <i>240 A/cm^2</i></p>
Compound Semiconductors		<p>7) Minority carriers are injected at one end of an n-type semiconductor and electric field of 70 V/cm is applied across it, which moves the carriers by 5 cm in $300 \mu\text{s}$. Calculate the diffusion constant of the minority carriers at 300 K 1 point</p> <p> <input type="radio"/> $100.4 \text{ cm}^2/\text{s}$ <input type="radio"/> $72.5 \text{ cm}^2/\text{s}$ <input type="radio"/> $6.2 \text{ cm}^2/\text{s}$ <input type="radio"/> $0.4 \text{ cm}^2/\text{s}$ </p>
Opto-electronic devices: Solar cells and photo-detectors		<p>No, the answer is incorrect. Score: 0</p>
Opto-electronic devices: Light Emitting Diodes (LED)		
Applications of transistors and basics of microelectronic fabrication		

Accepted Answers:

$6.2 \text{ cm}^2/\text{s}$

8) A semiconductor with $p_0 = 10^{16} \text{ cm}^{-3}$ is illuminated with light and 10^{12} cm^{-3} electron-hole pairs are generated every 3 μs . Find the minority carrier concentration. Assume $\tau_n = \tau_p = 1 \text{ } \mu\text{s}$ and $n_i = 10^{10} \text{ cm}^{-3}$

1 point

- 10^{10} cm^{-3}
- 10^{16} cm^{-3}
- $2 \times 10^{20} \text{ cm}^{-3}$
- $3 \times 10^{11} \text{ cm}^{-3}$

No, the answer is incorrect.

Score: 0

Accepted Answers:

$3 \times 10^{11} \text{ cm}^{-3}$

9) What is the charge state of an occupied donor (i.e. donor atom occupied by electron)?

1 point

- Negative
- Positive
- Neutral
- None of the above

No, the answer is incorrect.

Score: 0

Accepted Answers:

Neutral

10) What is the charge state of an unoccupied acceptor (i.e. acceptor atom not occupied by electron)?

1 point

- Positive
- Negative
- Neutral
- None of the above

No, the answer is incorrect.

Score: 0

Accepted Answers:

Neutral

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