

Unit 5 - Week 4 : Semiconductor junctions

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Assignment 4

The due date for submitting this assignment has passed. **Due on 2020-02-26, 23:59 IST.**
 As per our records you have not submitted this assignment.

1) In a Homojunction diode, the built-in voltage increases with 1 point

- Increase in dopant concentration.
- Increase in intrinsic carrier concentration.
- Decrease in width of depletion region.
- Decrease in band gap of material.

No, the answer is incorrect.
 Score: 0
 Accepted Answers:
 Increase in dopant concentration.

2) At equilibrium, what is the value of built-in voltage of P-N junction diode? The donor and acceptor concentrations are $5 \times 10^{16} \text{ cm}^{-3}$ and $5 \times 10^{16} \text{ cm}^{-3}$ respectively and the intrinsic carrier concentration is $1.5 \times 10^{10} \text{ cm}^{-3}$ at 300K. 1 point

- 0.66 V
- 0.70 V
- 0.78 V
- 0.72 V

No, the answer is incorrect.
 Score: 0
 Accepted Answers:
 0.78 V

3) At equilibrium, for a PN junction diode under dark, which of the following is/are true? 1 point

- The total current is zero.
- The directions of electron and hole currents due to diffusion are opposite.
- The total electrons and hole currents due to drift and diffusion are independently zero.
- The directions of hole currents due to drift and diffusion are opposite and they have equal in magnitude.

No, the answer is incorrect.
 Score: 0
 Accepted Answers:
 The total current is zero.
 The total electrons and hole currents due to drift and diffusion are independently zero.
 The directions of hole currents due to drift and diffusion are opposite and they have equal in magnitude.

4) Which of the following decrease(s) in a P-N junction diode under forward bias? 1 point

- Built-in potential
- Electric field
- Depletion region width
- Diffusion length

No, the answer is incorrect.
 Score: 0
 Accepted Answers:
 Electric field
 Depletion region width

5) In a P-N junction diode, the depletion region width on P-side is 6 times of that on N- side. Built-in potential is 0.8 V and intrinsic carrier concentration 10^7 cm^{-3} at 300K. Given relative permittivity(ϵ_r) and free space permittivity(ϵ_0) are 13 and 8.854×10^{-14} Farad/cm. 1 point

What is the donor concentration (in cm^{-3}) in diode?

- 3.43×10^{12}
- 1.96×10^{13}
- 1.17×10^{14}
- 2.63×10^{15}

No, the answer is incorrect.
 Score: 0
 Accepted Answers:
 1.17×10^{14}

6) In a P-N junction diode, the depletion region width on P-side is 6 times of that on N- side. Built-in potential is 0.8 V and intrinsic carrier concentration 10^7 cm^{-3} at 300K. Given relative permittivity(ϵ_r) and free space permittivity(ϵ_0) are 13 and 8.854×10^{-14} Farad/cm. 1 point

What is the total depletion width (in μm) of diode?

- 0.6
- 1.7
- 5.2
- 8.3

No, the answer is incorrect.
 Score: 0
 Accepted Answers:
 8.3

7) In a depletion region of a P-N junction diode 1 point

- The variation of electric field with position is linear.
- The maximum value of potential occurs at the junction of diode.
- Ratio of depletion region width of N and P sides depends on the ratio of dopant concentration.
- Charge density gradients is proportional to electric field.

No, the answer is incorrect.
 Score: 0
 Accepted Answers:
 The variation of electric field with position is linear.
 Ratio of depletion region width of N and P sides depends on the ratio of dopant concentration.

8) In homojunction diode, donor and acceptor concentration are 10^{16} cm^{-3} and 10^{15} cm^{-3} respectively. Which of the following is/are larger in magnitude in the depletion region in N side as compare to P side of the diode? 1 point

- Electric field gradients.
- Depletion region width.
- Built-in potential drop.
- Charge density.

No, the answer is incorrect.
 Score: 0
 Accepted Answers:
 Electric field gradients.
 Charge density.

9) What is the value of minority carrier (hole) concentration (in cm^{-3}) at the edge of depletion region in silicon based P-N junction diode with an N-type doping concentration 10^{16} cm^{-3} and forward biased with applied voltage 0.65 V at 300K? Given intrinsic carrier concentration 10^{10} cm^{-3} at 300K. 1 point

- 1.0×10^4
- 6.3×10^{12}
- 3.2×10^{13}
- 7.2×10^{14}

No, the answer is incorrect.
 Score: 0
 Accepted Answers:
 7.2×10^{14}

10) Which of the following assumption(s) is/are made in bulk regions of P-N junction diode for calculation of total current in forward bias? 1 point

- Low level injection maintained.
- Minority carrier current is primarily diffusive.
- No generation and recombination.
- Negligible potential drop.

No, the answer is incorrect.
 Score: 0
 Accepted Answers:
 Low level injection maintained.
 Minority carrier current is primarily diffusive.
 Negligible potential drop.

11) In P-N junction diode, donor and acceptor concentrations are 10^{17} cm^{-3} and 10^{16} cm^{-3} respectively and the intrinsic carrier concentration is 10^{10} cm^{-3} at 300 K. What is the maximum value of applied voltage (in volt) without violating the assumption of low-level injection (violation occurs when minority carrier concentration reaching 10% of majority carrier concentration)? 1 point

- 0.574
- 0.658
- 0.712
- 0.778

No, the answer is incorrect.
 Score: 0
 Accepted Answers:
 0.658

12) What is the ratio of diffusion length of electron and hole? Given diffusion coefficients are 33.75 and 12.4 cm^2/s , carrier mobilities are 801 and 438 $\text{cm}^2/\text{V-s}$, carrier life times are 0.01 and 0.1 μs for electron and hole respectively. 1 point

- 0.247
- 0.521
- 1.916
- 4.048

No, the answer is incorrect.
 Score: 0
 Accepted Answers:
 0.521

13) The reverse saturation current of P-N junction diode does not depend on: 1 point

- Carrier life time.
- Diffusion length.
- Applied bias.
- Minority carrier concentration.

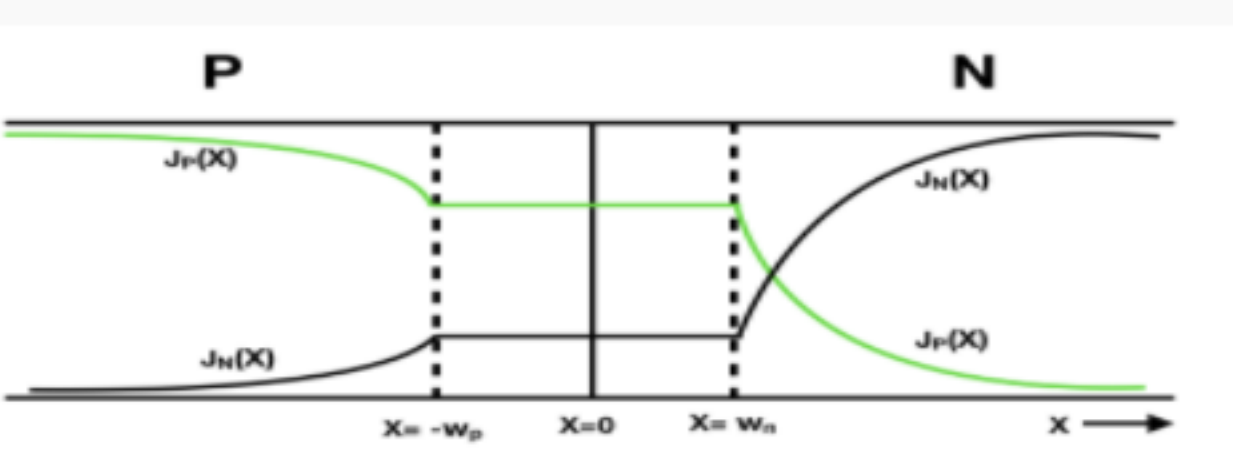
No, the answer is incorrect.
 Score: 0
 Accepted Answers:
 Applied bias.

14) What is the junction potential of homojunction diode under a forward bias with applied voltage 0.3 V? Given doping concentration on P- and N-sides of diode is 10^{14} cm^{-3} and intrinsic carrier concentration 10^7 cm^{-3} at 300K. 1 point

- 0.30
- 0.53
- 0.71
- 0.84

No, the answer is incorrect.
 Score: 0
 Accepted Answers:
 0.53

15) Which of the following relation is used for the determination of total current in PN junction diode shown below? 1 point



- $J^{\text{Total}} = J_p(w_n) + J_n(w_n)$
- $J^{\text{Total}} = J_p(-w_p) + J_n(-w_p)$
- $J^{\text{Total}} = J_p(-w_p) + J_n(w_n)$
- $J^{\text{Total}} = J_p(w_n) + J_n(-w_p)$

No, the answer is incorrect.
 Score: 0
 Accepted Answers:
 $J^{\text{Total}} = J_p(w_n) + J_n(-w_p)$