

# 18PYB103J Semiconductor Physics

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NAME

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1. At 0K, the pure semiconductor acts as a perfect insulator, since the \_\_\_\_\_ bonds are strong and no free electrons are available.

- ☒ a. Covalent
- ☐ b. Ionic
- ☐ c. Metallic
- ☐ d. Sigma

2. When  $T = 0\text{K}$ , the Fermi energy ( $E_F$ ) of intrinsic semiconductor is equal to \_\_\_\_\_

- ☐ a.  $EV/2$
- ☐ b.  $EC/2$
- ☒ c.  $[EV+EC]/2$
- ☐ d.  $EV-EC/2$

3. The electrical conductivity of intrinsic semiconductor is equal to \_\_\_\_\_

$$\sigma = n_e e \mu_e + n_h e \mu_h$$

☒ Option 1

$$\sigma = n_e e \mu_e - n_h e \mu_h$$

☐ Option 2

$$\sigma = n_e e \mu_h + n_h e \mu_e$$

☐ Option 3

$$\sigma = n_e e \mu_e / n_h e \mu_h$$

☐ Option 4

4. The Fermi level of n-type semiconductor \_\_\_\_\_ with increase in temperature.

- ☒ a. Decreases
- ☐ b. Increases
- ☐ c. remains unchanged
- ☐ d. becomes zero

5. When silicon is mixed with amount of pentavalent impurity elements \_\_\_\_\_ semiconductor crystal is formed.

- ☐ a. Pure
- ☐ b. p-type
- ☒ c. n-type
- ☐ d. Dilute magnetic

6. In n-type semiconductor, the donor level is so close to the bottom of the \_\_\_\_\_.

- ☐ a. Valence band
- ☒ b. Conduction band
- ☐ c. Bottom of valence band
- ☐ d. Top of conduction band

7. In a p type semiconductor at relatively low temperatures, the \_\_\_\_\_ atoms get ionised taking electrons from valence band and thus creating holes .

- ☐ a. Donor
- ☐ b. Divalent
- ☒ c. Acceptor
- ☐ d. Pentavalent

8. The majority charge carriers in p-type semiconductor is \_\_\_\_\_

- ☐ a. Electrons
- ☐ b. Both electrons and holes
- ☐ c. Neutrons
- ☒ d. Holes

9. When  $T = 0\text{K}$ , the Fermi energy ( $E_F$ ) of p-type semiconductor is equal to \_\_\_\_\_

- ☐ a.  $E_F/2$
- ☒ b.  $[E_V + E_a]/2$
- ☐ c.  $E_a/2$
- ☐ d.  $E_V/2$

10. \_\_\_\_\_ is a process by which electrons gain energy and move from the valence band to the conduction band, producing two distinct mobile carriers such as EHPs (electron-hole pairs)

- ☐ a. Carrier recombination
- ☐ b. Spontaneous emission
- ☐ c. Stimulated emission
- ☒ d. Carrier generation

11. In \_\_\_\_\_ generation process, an electron and a hole recombine in a band-to-band transition, but the resulting energy is given off to another electron or hole.

- ☒ a. Auger
- ☐ b. band to band
- ☐ c. Impurity to band
- ☐ d. None of above

12. Avalanche breakdown is caused by impact ionisation of electron-hole pairs by carriers that have gained energy by accelerating in the high electric field in the depletion region of a.....biased p-n diode.

- ☐ a. Forward
- ☒ b. Reverse
- ☐ c. Positive
- ☐ d. Negative

13. The random motion of holes and free electrons due to thermal agitation is called .....

- ☒ a. Diffusion
- ☐ b. Pressure
- ☐ c. Ionisation
- ☐ d. Drift

14. A p-type semiconductor material is doped with ..... impurities whereas a n-type semiconductor material is doped with ..... impurities.

- ☒ a. Acceptor, Donor
- ☐ b. Acceptor, Acceptor
- ☐ c. Donor, Donor
- ☐ d. Donor, Acceptor

15. Which of the below mentioned statements is false regarding a p-n junction diode?

- ☐ a. Diode are 2 terminal devices
- ☐ b. Diodes are rectifying devices
- ☐ c. Diodes are unidirectional devices
- ☒ d. Diodes have three terminals

16. When a physical contact between a p-region & n-region is established which of the following is most likely to take place?

- ☐ a. Electrons from N-region diffuse to P-region
- ☐ b. Holes from P-region diffuse to N-region
- ☒ c. Both of the above mentioned statements are true
- ☐ d. Nothing will happen

17. What is the continuity equation with flow of current {J} in words? \*

- ☐ a. Rate of increase of  $J = (\text{inflow} - \text{outflow}) + \text{drift} - \text{diffusion}$
- ☒ b. Rate of increase of  $J = (\text{inflow} - \text{outflow}) + \text{generation} - \text{recombination}$
- ☐ c. Rate of increase of  $J = (\text{inflow} - \text{outflow})$
- ☐ d. Rate of increase of  $J = (\text{inflow} + \text{outflow})$

18. When a reverse bias is applied to a diode, it will

- ☒ a. Raise the potential barrier
- ☐ b. Lower the potential barrier
- ☐ c. No change in potential barrier
- ☐ d. None of these

19. For a PN junction diode, the current in reverse bias may be

- ☐ a. Few kilo amperes
- ☐ b. infinite
- ☐ c. Few amperes
- ☒ d. Few micro amperes to nano amperes

20. As a PN junction is forward biased ,which is not true?

- ☒ a. Holes as well as electrons tend to drift away from the junction
- ☐ b. The depletion region decreases
- ☐ c. The barrier tends to breakdown
- ☐ d. P region is connected to positive terminal



21. The rectifying metal-semiconductor junction is also called as

- ☐ a. Ohmic Junction
- ☒ b. Schottky Junction
- ☐ c. Conducting Junction
- ☐ d. PN Junction

22. When the work function of metal is smaller than that of n type semiconductor it forms

- ☒ a. Non rectifying Junction
- ☐ b. Rectifying Junction
- ☐ c. Conducting Junction
- ☐ d. PN Junction

23. Whenever, the work function of metal is larger than that of n type semiconductor it forms

- ☐ a. Ohmic Junction
- ☒ b. Schottky Junction
- ☐ c. Conducting Junction
- ☐ d. PN Junction

24. Which of the following junction conducts on both forward bias and reverse bias

- ☒ a. Non rectifying Junction
- ☐ b. Schottky Junction
- ☐ c. Semiconductor-Insulator Junction
- ☐ d. Metal-Insulator Junction

25. The expression for drift current density due to electrons is given by

- ☐ a.  $J = p\mu_e E$
- ☐ b.  $J = p\mu_e V$
- ☒ c.  $J = n\mu_e E$
- ☐ d.  $J = n\mu_e V$

26. The expression for diffusion current density due to electrons is given by

- ☐ a.  $J = -eD_n E (dn/dx)$
- ☐ b.  $J = -ieD_n (dn/dx)$
- ☐ c.  $J = -eD_n v (dn/dx)$
- ☒ d.  $J = -eD_n (dn/dx)$

27. For a direct band gap material the change in momentum for a transition is -----

- ☐ a. one
- ☒ b. zero
- ☐ c.  $1/2$
- ☐ d. infinite

28. A light emitting diode is ..... diode.

- ☒ a. Heavily doped
- ☐ b. Lightly doped
- ☐ c. Intrinsic semiconductor
- ☐ d. None of the above

29. Photo diode acts as a

- ☐ a. Inductor
- ☐ b. Capacitor
- ☒ c. Sensor
- ☐ d. Insulator

30. Photo diode operates on \_\_\_\_\_.

- ☒ a. Reverse Bias
- ☐ b. Forward Bias
- ☐ c. Without any Bias
- ☐ d. None of the above

31. Which process of the Electron-hole pair is responsible for emitting of light?

- ☐ a. Generation
- ☐ b. Ionisation
- ☒ c. Recombination
- ☐ d. Diffusion

32. The dome shaped LED is preferred

- ☐ a. to enhance optical losses
- ☐ b. to enhance phonon losses
- ☒ c. to reduce optical losses
- ☐ d. to reduce phonon losses

33. .... is the critical angle if the refractive index of the LED material is 2.9.

- ☐ a. 15
- ☒ b. 20
- ☐ c. 16
- ☐ d. 17

34. What is full form of OLED?

- ☒ a. Organic light emitting diode
- ☐ b. Optical light emitting diode
- ☐ c. Active motion organic light emitting diode
- ☐ d. Array motion organic light emitting diode

35. A transition will proceed more rapidly if the coupling between the initial and final energy states is

- ☒ a. stronger
- ☐ b. weaker
- ☐ c. removed
- ☐ d. very weaker

36. .... the wavelength of radiation given out by an LED with an energy of 3 eV, given that  $h = 6.626 \times 10^{-34} \text{ m}^2 \text{ kg/s}$  and  $C = 3 \times 10^8 \text{ m/s}$ .

- ☐ a. 345.6 nm
- ☐ b. 437.1 nm
- ☐ c. 548.2 nm
- ☒ d. 414 nm

37. In semiconductor the transition that takes place between valence band and conduction band is called as .....

- ☒ a. Interband transition
- ☐ b. Intraband transition
- ☐ c. Impurity level transition
- ☐ d. Free carrier transition

38. Photon energy flow per unit volume .....

- ☐ a. Electron density
- ☐ b. Energy density
- ☒ c. Photon density
- ☐ d. Phonon density

39. In semiconductors if the transition takes place between a donor (or) acceptor level to a band called as .....

- ☐ a. Interband transition
- ☐ b. Intraband transition
- ☐ c. Intrinsic semiconductor
- ☒ d. Impurity level transition

40. Free carrier transition also called as .....

- ☐ a. Interband transition
- ☒ b. Intraband transition
- ☐ c. Impurity level transition
- ☐ d. Carrier generation

41. .... is the process in which a transition of electron from valence band to conduction band takes place with the help of photon \*

- ☒ a. Absorption
- ☐ b. Emission
- ☐ c. Conducting Layer
- ☐ d. Emissive Layer

42. ....is the process where electron hole pairs created and recombined non radiatively.

- ☒ a. Trap assisted recombination
- ☐ b. Cathodoluminescence
- ☐ c. stimulated emission
- ☐ d. Electroluminescence

43. The annihilation of positively charged holes and negatively charged impurity or free electrons are called as .....

- ☒ a. Recombination
- ☐ b. Generation
- ☐ c. Absorption
- ☐ d. Phosphorescence

44. Optical processes directly involve a \_\_\_\_\_absorption and emission

- ☐ a. Electron
- ☐ b. Proton
- ☒ c. Photon
- ☐ d. neutron



45. ----- Statistics can be applied to identical, indistinguishable particles of half spin.

- ☐ a. Bose- Einstein
- ☒ b. Fermi-Dirac
- ☐ c. Maxwell-Boltzmann
- ☐ d. Bose-Dirac

46. The Einstein coefficient for spontaneous and stimulated emission is \_\_\_\_\_

$$\frac{A_{21}}{B_{21}} = \frac{8\pi k c}{\lambda^5}$$

☐ a

$$\frac{A_{21}}{B_{21}} = \frac{8bhc}{\lambda^5}$$

☐ b

$$\frac{A_{21}}{B_{21}} = \frac{8\pi rc}{\lambda^5}$$

☐ c

$$\frac{A_{21}}{B_{21}} = \frac{8\pi hc}{\lambda^5}$$

☒ d

47..... is the process of radiative recombination of electron-hole pairs created by electron bombardment.

- ☐ a. Luminescence
- ☒ b. Cathodoluminescence
- ☐ c. Photoluminescence
- ☐ d. Electroluminescence

48. Photons emitted by spontaneous emission are \_\_\_\_\_

- ☐ a) Coherent and Monochromatic
- ☐ b) Non-coherent and monochromatic
- ☐ c) Coherent and Non-Monochromatic
- ☒ d) Non-Coherent and Non-monochromatic
- ☐ Option 1

49. Identify the Einstein co efficient related to Stimulated emission

- ☒ a.  $B_{21}$
- ☐ b.  $A_{12}$
- ☐ c.  $A_{21}$
- ☐ d.  $B_{12}$

50. Which of the following is not an opto electronic device?

- ☐ a. solar cell
- ☐ b. LED
- ☐ c. photo diode
- ☒ d. capacitor

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