NEET ANSWER KEY & SOLUTIONS

SUBJECT :- PHYSICS
CLASS :- 12th **PAPER CODE :- CWT-11**
CHAPTER :- SEMICONDUCTOR

ANSWER KEY

1.	(C)	**2.**	(A)	**3.**	(B)	**4.**	(B)	**5.**	(B)	**6.**	(D)	**7.**	(A)
8.	(D)	**9.**	(B)	**10.**	(B)	**11.**	(A)	**12.**	(B)	**13.**	(C)	**14.**	(C)
15.	(C)	**16.**	(A)	**17.**	(B)	**18.**	(A)	**19.**	(C)	**20.**	(C)	**21.**	(B)
22.	(D)	**23.**	(A)	**24.**	(B)	**25.**	(C)	**26.**	(C)	**27.**	(B)	**28.**	(B)
29.	(B)	**30.**	(A)	**31.**	(D)	**32.**	(D)	**33.**	(C)	**34.**	(B)	**35.**	(A)
36.	(D)	**37.**	(C)	**38.**	(D)	**39.**	(A)	**40.**	(A)	**41.**	(D)	**42.**	(B)
43.	(D)	**44.**	(D)	**45.**	(D)	**46.**	(B)	**47.**	(B)	**48.**	(D)	**49.**	(D)
50.	(A)												

SOLUTIONS

SECTION-A

1. (C)

2. (A)
Sol. With temperature rise conductivity of semiconductors increases, that's why resistance of semiconductor is decrease.

3. (B)
Sol. Ge + Pantavalen t impurity → N - type semiconduc tor

4. (B)
Sol. Impurity increases the conductivity.

5. (B)

6. (D)
Sol. In *P*-type semiconductors, holes are majority charge carrier and electrons are minority charge carriers.

7. (A)
Sol. Phosphorus is a pentavalent impurity so $n_e > n_h$.

8. (D)

9. (B)
Sol. As maximum energy does not depend on the intensity of light.

10. (B)

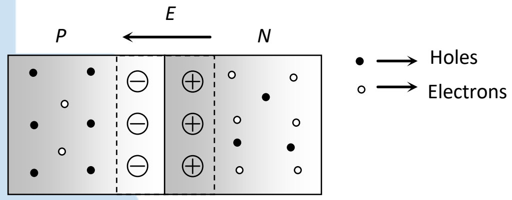
11. (A)
Sol. Depletion layer consist of mainly stationary ions.

12. (B)
Sol. Current flow is possible and

$$i = \frac{V}{R} = \frac{(4-1)}{300} = 10^{-2} A$$

13. (C)
Sol. After a large reverse voltage is *PN*-junction diode, a huge current flows in the reverse direction suddenly. This is called Breakdown of *PN*-junction diode.

14. (C)
Sol. At junction a potential barrier/depletion layer is formed, with *N*-side at higher potential and *P*-side at lower potential. Therefore there is an electric field at the junction directed from the *N*-side to *P*-side



15. (C)
Sol. In forward biasing of *PN*-junction diode, current mainly flows due to the diffusion of majority charge carriers.

16. (A)
Sol. At high reverse voltage, the minority charge carriers, acquires very high velocities. These by collision break down the covalent bonds, generating more carriers. This mechanism is called Avalanche breakdown.

17. (B)
Sol. When reverse bias is increased, the electric field at the junction also increases. At some stage the electric field breaks the covalent bond, thus the large number of charge carriers are generated. This is called Zener breakdown.

18. (A)

19. (C)

20. (C)

Sol. In photodiode, it is illuminated by light radiations, which in turn produces electric current.

21. (B)

Sol. For 'OR' gate $X = A + B$

i.e. $0+0=0$, $0+1=1$, $1+0=1$, $1+1=1$

22. (D)

Sol. The output *D* for the given combination

$D = \overline{(A+B).C} = \overline{(A+B)} + \overline{C}$

If $A = B = C = 0$ then

$D = \overline{(0+0)} + \overline{0} = \overline{0} + \overline{0} = 1 + 1 = 1$

If $A = B = 1$, $C = 0$ then

$D = \overline{(1+1)} + \overline{0} = \overline{1} + \overline{0} = 0 + 1 = 1$

23. (A)

Sol. The Boolean expression for 'NOR' gate is $Y = \overline{A+B}$

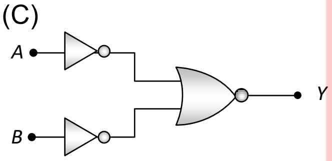
i.e. if $A = B = 0$ (Low), $Y = \overline{0+0} = \overline{0} = 1$ (High)

24. (B)

Sol. For 'AND' gate, if output is 1 then both inputs must be 1.

25. (C)

Sol.



$Y = \overline{\overline{A} + \overline{B}}$

According to De morgan's theorem

$Y = \overline{\overline{A} + \overline{B}} = \overline{\overline{A}}.\overline{\overline{B}} = A.B$

This is the output equation of 'AND' gate.

26. (C)

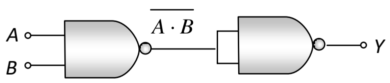
27. (B)

Sol. The output of OR gate is $Y = A + B$.

28. (B)

29. (B)

Sol. Two 'NAND' gates are required as follows



$Y = \overline{\overline{AB}.\overline{AB}} = AB$

30. (A)

31. (D)

32. (D)

33. (C)

Sol. If $V_A > V_B$, the diode is in forward biased and the current passes through both the resistances. So equivalent resistance Req = 5Ω

If $V_A < V_B$, the diode is in reverse biased, thus hardly any current would pass through the upper resistance of 10Ω

Thus, Req = 10Ω.

34. (B)

35. (A)

SECTION-B

36. (D)

Sol. For full wave rectifier $\eta = \dfrac{81.2}{1 + \dfrac{r_f}{R_L}}$

$\Rightarrow \eta_{max} = 81.2\% \quad (r_f << R_L)$

37. (C)

38. (D)

Sol. In a p-n junction diode, majority carriers are holes on p-side and electrons on n-side. Holes, thus diffuse to n-side and electrons to p-side. Thus diffusion causes an excess positive charge in then-region and an excess negative charge in the p-region and an excess negative charge in the p-region near the jjunction. Thus double layer of charge creates an electric field which exerts a force on the electrons and holes, against their diffusion. Thus electric field becomes strong enough as diffusion proceeds to stop it. In the equilibrium position, there is a barrier, for charge motion with the n-side at a higher potential then the p-side.

The junction region has a very low density of either p or n-type carriers, because of inter diffusion. It is called depletion region. There is a barrier V_B associated with it. This is the potential barrier.

39. (A)

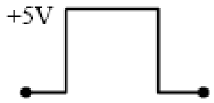
Sol. When the connection of battery is reversed, then a semiconduction device is reverse biased. We know that in forward biasing of p-n junction the current is of the order of milliampere while in reverse biassing the current is of the order of microampere (negigible). Thus, device is a p -n junction.

40. (A)

Sol. Due to have revise blasing the width of deplection region increases and current flowing throgh the diode is almost zero . In the case electric field is almost zero at the middle of the depletion region

41. (D)

Sol. Diode is forward biased in first half cycle and amplitude of signal is 5V.



Correct choice: (D)

42. (B)

Sol. Diode in revers by so current thrugh A_1 is zero.

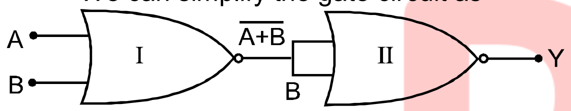
43. (D)

Sol. The term LED is abbreviated as 'Light Emitting Diode'. It is forward biased p-n junction which emits spontaneous radiation. Current in the circuit = 10 mA = 10×10^{-3} A and voltage in the circuit = 6 – 2 = 4v. From ohm's law,

$$\therefore \quad R = \frac{V}{I} = \frac{4}{10 \times 10^{-3}} = 400\ \Omega$$

44. (D)

Sol. **Key Idea :** Gates-I and II are NOR gates.
We can simplify the gate circuit as

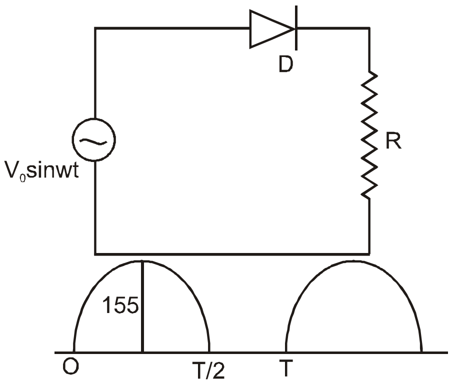


Here. gates-I and II are NOR gates. The output $(\overline{A + B})$ of gate-I will be appeared as input of gate-II. The final output is
$Y = \overline{\overline{A + B}} = A + B$
This is the Boolean expression of OR gate whose truth table is given below :

A	B	Y
0	0	0
0	1	1
1	0	1
1	1	1

45. (D)

Sol.



$$V_{rms} = \left(\frac{V_0}{2}\right) = \frac{155}{2} = 77.5 \text{volt}$$

$$V_0 = \frac{310}{2} = 155 \text{ volt.}$$

46. **(B)**

Sol. $Y = \overline{A \cdot A} = \bar{A} + \bar{A} = \bar{A}$, which is a NOT gate.

47. (B)

Sol. The device that can act as a complete circuit is integrated circuit (I.C.).

48. (D)

Sol. $n_i^2 = n_e n_h$

$(1.5 \times 10^{16})^2 = n_e(4.5 \times 10^{22})$

$n_e = 0.5 \times 10^{10}$

$n_e = 5 \times 10^9$

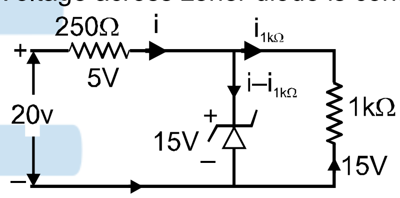
$n_h = 4.5 \times 10^{22}$

$n_h >> n_e$

Semiconductor is p–type and $n_e = 5 \times 10^9$ m^{-3} .

49. (D)

Sol. Voltage across zener diode is constant



$$(i)_{1k\Omega} = \frac{15 \text{ volt}}{1k\Omega} = 15 \text{ mA}$$

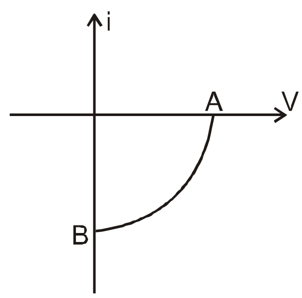
$$(i)_{250\Omega} = \frac{(20-15)V}{250\Omega} = \frac{5V}{250\Omega} = \frac{20}{1000} A$$

= 20 mA

$\therefore \quad (i)_{\text{zener diode}} = (20 - 15) = 5$ mA.

50. (A)

Sol.



It is V – i cherecterstic curve for a solar cell, where A represent open circuit voltage of solar cell and B represent short circuit current.