# Semiconductor Electronics - Materials, Devices and Simple Circuits

1. **Assertion (A):** NPN transistor is preferred over PNP transistor.
**Reason (R):** Mobility of hole is more than free electron.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

2. **Assertion (A):** The number of electrons in n-type semiconductor is higher than the number of electrons in a pure silicon semiconductor.
**Reason (R):** The law of mass action is applicable only to n-type semiconductors.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

3. **Assertion (A):** A transistor amplifier in common emitter configuration has a low input impedance.
**Reason (R):** The base to emitter region is forward biased.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

4. **Assertion (A):** In solid each electron will have a different energy level.
**Reason (R):** In solid crystal each electron has a unique position and no two electrons see exactly the same pattern of surrounding charges.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

5. **Assertion (A):** The conductivity of an intrinsic semiconductor depends on its temperature.
**Reason (R):** No important electronic device can be developed using intrinsic semi conductor.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

6. **Assertion (A):** Width of depletion region is reduced in forward bias.
**Reason (R):** In forward bias external battery reduced the internal electric field in depletion layer.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

7. **Assertion (A):** Bridge full wave rectifier is more used than centre tap full wave rectifier.
**Reason (R):** In bridge full wave rectifier four diodes are used.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

8. **Assertion (A):** The semiconductor used for fabrication of visible LED must at least have a band gap of 1.8 eV.
**Reason (R):** The spectral range of visible light is from 0.4 eV to 1.8 eV.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

9. **Assertion (A):** In an OR gate if any of the input is high the output is high.
**Reason (R):** OR gate is the basic gate.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

10. **Assertion (A):** In an oscillator, the feedback is in the same phase which is called as positive feedback.
**Reason (R):** If the feedback voltage is in opposite phase the gain is greater than one.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

11. **Assertion (A):** Working principle of photodiode and photocell is same.
**Reason (R):** Biasing circuit for photodiode and photocell is same.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

12. **Assertion (A):** GaAs is preferred for making solar panels.
**Reason (R):** $\Delta E_g$ for GaAs is 1.5 eV and sun's radiation has highest intensity around this energy level.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

13. **Assertion (A):** In LED $e^-$-hole pair recombination gives us photon.
**Reason (R):** In LED $e^-$-hole pair recombination occurs in depletion region.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

14. **Assertion (A):** As we increase applied voltage on LED intensity of emitted light first increases then decreases.
**Reason (R):** We use LED in forward bias.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

15. **Assertion (A):** In a N-type semiconductor, the number of holes get reduced.
**Reason (R):** Rate of recombination of holes would increase due to the increase in the number of electrons
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

16. **Assertion (A):** Electron hole recombination takes place in P-region and N-region of PN Junction diode except in depletion region.
**Reason (R):** Electric field in depletion region oppose the diffusion.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

17. **Assertion (A):** In a transistor, collector current in active state is almost independent of potential difference of collector and emitter.
**Reason (R):** Base emitter junction of a transistor is in forward bias in active state
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

18. **Assertion (A):** Output frequency of time varying DC voltage in a full wave rectifier is twice of input frequency.
**Reason (R):** A center tap transformer increases the frequency of input.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

19. **Assertion (A):** A NAND gate can be obtained by using NOR gates.
**Reason (R):** NOR, NAND and XOR gates are called universal gates.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

20. **Assertion (A):** Width of depletion region is reduced in forward bias.
**Reason (R):** In n-type semiconductor majority charge carriers are free electrons while in p-type they are holes.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

21. **Assertion (A):** Transistor can be used as an amplifier & oscillator.
**Reason (R):** In transistor, collector is larger in size as compared to the emitter.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

22. **Assertion (A):** The drift current in a p–n junction is from n-side to p-side.
**Reason (R):** The diffusion current in a p–n junction is from p–side to n–side.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

23. **Assertion (A):** P-type semiconductor has high density of holes in valence band while N-type semiconductor has high density of electrons in conduction band.
**Reason (R):** In N-type semiconductor, as the density of donor atoms $N_D$ is increased, the fermi energy level shifts towards the valence band.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

24. **Assertion (A):** Generally npn transistors are widely used.
**Reason (R):** In npn transistor the mobility of majority charge carriers is more.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

25. **Assertion (A):** Light emitting diode (LED) emits self radiation.
**Reason (R):** LED are reverse biased p-n junctions.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

26. **Assertion (A):** Conductivity of intrinsic semiconductor is less as compared to extrinsic semiconductor.
**Reason (R):** With increase in temperature conductivity of semiconductor increases.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

27. **Assertion (A):** Avalanche breakdown dominates when the doping concentration is high and depletion layer is thin.
**Reason (R):** Zener breakdown occurs due to the collision of minority charge carrier.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

28. **Assertion (A):** Semiconductors do not obey Ohm's law.
**Reason (R):** Electric current is determined by the rate of flow of charge carriers.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

29. **Assertion (A):** The temperature coefficient of resistance is positive for metals and negative for semiconductors.
**Reason (R):** On raising the temperature, in metals drift velocity increases but in semiconductors more charge carriers are released.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

30. **Assertion (A):** The temperature coefficient of resistance is positive for p-type semiconductors and negative for n-type semiconductors.
**Reason (R):** The effective charge carriers in p-type semiconductors are electrons and in n-type semiconductors are holes.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**31.** **Assertion (A):** The probability of electrons to be found in the conduction band of an intrinsic semiconductor at a finite temperature decreases exponentially with increasing band gap.
**Reason (R):** It is more difficult for the electrons to jump to the conduction band from the valence band if the band gap between them is large.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**32.** **Assertion (A):** The logic gate NOT can not built using diode.
**Reason (R):** The output voltage and the input voltage of the diode does not have 180° phase difference.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**33.** **Assertion (A):** Two p-n junction diodes placed back to back, will work as an n-p-n transistor.
**Reason (R):** The p-region of two p-n junction diodes back to back will form the base of n-p-n transistor.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**34.** **Assertion (A):** When base region has larger width, the collector current decreases.
**Reason (R):** In transistor, sum of base current and collector current is equal to emitter current.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

## ANSWER KEY

| Que. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ans. | 3 | 3 | 1 | 1 | 2 | 1 | 2 | 3 | 2 | 3 | 3 | 1 | 3 | 2 | 1 | 2 | 2 | 3 | 3 | 2 |
| Que. | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | | | | | | |
| Ans. | 2 | 2 | 3 | 1 | 4 | 2 | 4 | 2 | 3 | 4 | 1 | 1 | 4 | 2 | | | | | | |