QB365 Question Paper Software
12th Standard - Physics
Semiconductor Electronics: Materials, Devices and Simple Circuits Assertion and reason

Exam Time: 00:20 Hrs | Date: 2025-09-30
Total Marks: 10

Questions:

1. **Assertion (A)** : The depletion layer in the p-n junction is free from mobile charge carriers.
Reason (R) : There is no electric field across the junction barrier.
Codes:
(a) Both A and R are true and R is the correct explanation of A
(b) Both A and R are true but R is NOT the correct explanation of A
(c) A is true but R is false
(d) A is false and R is also false

2. **Assertion (A)** : At absolute zero the conductivity of semiconductor is zero.
Reason (R) : In a semiconductor there are no free electrons at any temperature.
Codes:
(a) Both A and R are true and R is the correct explanation of A
(b) Both A and R are true but R is NOT the correct explanation of A
(c) A is true but R is false
(d) A is false and R is also false

3. **Assertion (A)** : V - I characteristic of p-n diode is same as that of any other conductor.
Reason (R) : p-n diode behave as conductor at room temperature.
Codes:
(a) Both A and R are true and R is the correct explanation of A
(b) Both A and R are true but R is NOT the correct explanation of A
(c) A is true but R is false
(d) A is false and R is also false

4. **Assertion (A)** The electrical conductivity of a semiconductor increases on doping.
Reason (R) Doping always increases the number of electrons in the semiconductor.
(a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
(b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
(c) Assertion is true but Reason is false.
(d) Assertion is false but Reason is true.

5. **Assertion :** In semiconductors, thermal collisions are responsible for taking a valence electron to the conduction band.
Reason : The number of conduction electrons go on increasing with time as thermal collisions continuously take place.
Codes:
(a) If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.
(b) If both Assertion and Reason are correct but Reason is not a correct explanation of

the Assertion.
(c) If the Assertion is correct but Reason is incorrect.
(d) If both the Assertion and Reason are incorrect.

6. **Assertion :** The number of electrons in a p-type silicon semiconductor is less than the number of electrons in a pure silicon semiconductor at room temperature.
Reason : It is due to law of mass action.
Codes:
(a) If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.
(b) If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.
(c) If the Assertion is correct but Reason is incorrect.
(d) If both the Assertion and Reason are incorrect.

7. **Assertion (A) :** p-n junction diode can be used even at ultra high frequencies.
Reason (R) : Capacitative reactance of a p-n junction diode increases as frequency increases.
Codes:
(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true but R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false and R is also false.

8. **Assertion (A) :** The ratio of free electrons to holes in intrinsic semiconductor is greater than one.
Reason (R) : The electrons are lighter particles and holes are heavy particles.
Codes:
(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true but R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false and R is also false.

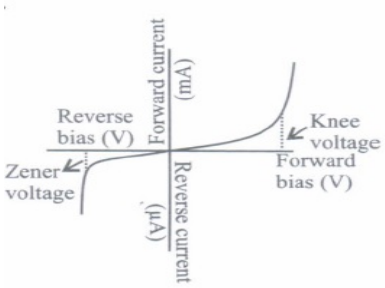
9. **Assertion (A)**: A p-n junction diode conducts current in the forward bias but not in the reverse bias.
Reason (R): In forward bias, the p-n junction allows the flow of majority carriers, facilitating current flow, while in reverse bias, the depletion region widens, preventing current flow.
Codes:
(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true but R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false and R is also false.

10. **Assertion (A):** The barrier potential of a silicon p-n junction is higher than that of a germanium p-n junction.
Reason (R): Silicon has a higher band gap than germanium, resulting in a higher barrier potential at the p-n junction.
Codes:
(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true but R is not the correct explanation of A.

(c) A is true but R is false.
(d) A is false and R is also false.

Answers Key:

1. **(c)**: Due to diffusion of holes from the p-region to the n-region and of electrons from the n-region to the p-region an electric field is set up across the junction barrier. Once the depletion layer is formed it is in equilibrium and becomes free of mobile charge carriers.
2. **(c)**: In a semiconductor, there are no free electrons at 0 K. The number of free electrons increases with increase in temperature because with increase in temperature the electron get sufficient energy to cross forbidden band and reach conduction band. But total number of free electrons in a semiconductor is less than that in a conductor.
3. **(d)** : The V-I characteristic of p-n diode depends whether the junction is forward biased or reverse biased. This can be showed by graph between voltage and current.



In the given graph knee voltage is a voltage at which forward bias becomes greater than the potential barrier, the forward current increases almost linearly, where as zener voltage is a voltage at which reverse current increases suddenly. From this graph we can verify that p-n diode characteristics are very different from that of conductor which obey's Ohm's law.

4. (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
5. (c) If the Assertion is correct but Reason is incorrect.
6. (a) If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.
7. (c) A is true but R is false.
8. (b) Both A and R are true but R is not the correct explanation of A.
9. (a) Both A and R are true and R is the correct explanation of A.
10. (a) Both A and R are true and R is the correct explanation of A.