Chapter 14

Semiconductor Electronics

(Assertion and Reason Questions)

Directions: These questions consist of two statements, each printed as Assertion and Reason. While answering these questions, you are required to choose any one of the following four responses.

(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.

Q.1. Assertion: A pure semiconductor has negative temperature coefficient of resistance.
Reason: In a semiconductor on raising the temperature, more charge carriers are released, conductance increases and resistance decreases.

Q.2. Assertion: If the temperature of a semiconductor is increased then its resistance decreases.
Reason: The energy gap between conduction band and valence band is very small.

Q.3. 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.

Q.4. Assertion: A p-type semiconductors is a positive type crystal.
Reason: A p- type semiconductor is an uncharged crystal.

Q.5. Assertion: Silicon is preferred over germanium for making semiconductor devices.
Reason: The energy gap in germanium is more than the energy gap in silicon.

Q.6. Assertion: Electron has higher mobility than hole in a semiconductor.
Reason: The mass of electron is less than the mass of the hole.

Q.7. 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.

Q.8. Assertion: When two semi conductor of p and n type are brought in contact, they form p-n junction which act like a rectifier.
Reason: A rectifier is used to convent alternating current into direct current.

Q.9. Assertion: Diode lasers are used as optical sources in optical communication.
Reason: Diode lasers consume less energy.

Q.10. Assertion: The diffusion current in a p-n junction is from the p-side to the n-side.
Reason: The diffusion current in a p-n junction is greater than the drift current when the junction is in forward biased.

Q.11. Assertion: The drift current in a p-n junction is from the n-side to the p-side.
Reason: It is due to free electrons only.

Q.12. Assertion: A p-n junction with reverse bias can be used as a photo-diode to measure light intensity.
Reason: In a reverse bias condition the current is small but it is more sensitive to changes in incident light intensity.

-x-x-x-

ANSWER KEY

Q.1 : (a) In semiconductors, by increasing temperature, covalent bond breaks and conduction hole and electrons increase.

Q.2 : (a) In semiconductors the energy gap between conduction band and valence band is small (1 eV). Due to temperature rise, electron in the valence band gain thermal energy and may jumpy across the small energy gap, (to the conduction band). Thus conductivity increases and hence resistance decreases.

Q.3 : (c)

Q.4 : (d) There is no charge on P-type semiconductor, because each atom of semiconductor is itself neutral.

Q.5 : (c) Silicon is cheaper than germanium, so it is preferred over germanium. But energy gap in germanium is smaller than silicon.

Q.6 : (a) **Q.7 :** (a)

Q.8 : (b) Study of junction diode characteristics shows that the junction diode offers a low resistance path, when forward biased and high resistance path when reverse biased. This feature of the junction diode enables it to be used as a rectifier.

Q.9 : (c) Statement – 1 is True, Statement- 2 is False

Q.10 : (d) Diffusion current is due to the migration of holes and electrons into opposite regions, so it will be from p-side to n-side. Also in forward bias it will increases.

Q.11 : (a) **Q.12 :** (a)