

1. What are the properties of Semiconductors?

1. Semiconductors act like insulators at zero Kelvin. On increasing the temperature, they work as conductors.
2. Due to their exceptional electrical properties, semiconductors can be modified by doping to make semiconductor devices suitable for energy conversion, switches and amplifiers.
3. Lesser power losses.
4. Semiconductors are smaller in size and possess less weight.
5. Their resistivity is higher than conductors but lesser than insulators.
6. The resistance of semiconductor materials decreases with an increase in temperature and vice-versa.

2. What are the differences between Intrinsic and Extrinsic Semiconductors?

| Intrinsic Semiconductor | Extrinsic Semiconductor |
|---|---|
| Pure semiconductor | Impure semiconductor |
| The density of electrons is equal to the density of holes | The density of electrons is not equal to the density of holes |
| Electrical conductivity is low | Electrical conductivity is high |
| Dependence on temperature only | Dependence on temperature, as well as on the amount of impurity |
| No impurities | Trivalent impurity and pentavalent impurity |

3. Write the Applications of Semiconductors

- Temperature sensors are made with semiconductor devices.
- They are used in 3D printing machines
- Used in microchips and self-driving cars
- Used in calculators, solar plates, computers and other electronic devices.
- Transistors and MOSFET used as a switch in electrical circuits are manufactured using semiconductors.

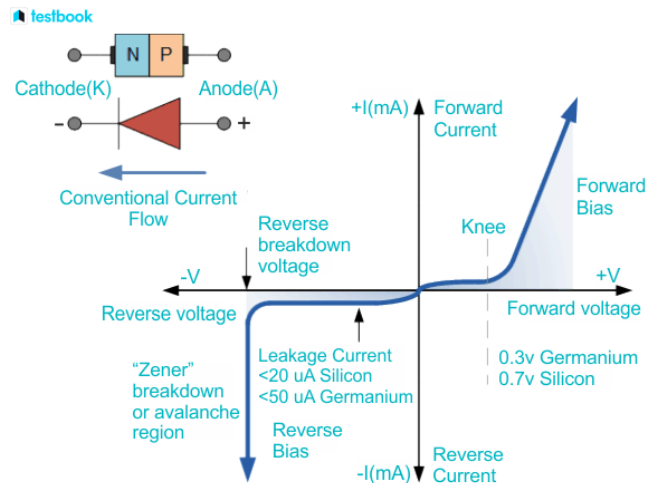
4. Write the differences between PN Junction Diode and Zener Diode are as follows

| PN Junction Diode | Zener Diode |
|---|---|
| The current flows in one direction only | The current can flow in both directions |
| Depletion layer of the PN junction gets completely damaged in reverse bias | In the Zener diode, the current flows in both the directions even in the reverse bias state |
| The PN region is lightly doped in a PN junction diode which makes the depletion region wider. | The depletion region is narrower in the Zener diode as the PN junction is doped heavily. |
| The main application of the PN junction diode is in the process of rectification | Zener diodes are mainly used for voltage regulation purposes. |

5. What is Zener Effect?

The Zener effect is a type of electrical breakdown that occurs in a reverse-biased PN junction when the electric field enables tunnelling of electrons from the valence to the conduction band of a semiconductor, leading to a large number of free minority carriers which suddenly increase the reverse current. The Zener effect is best-known for its use in the appropriately-named Zener diode.

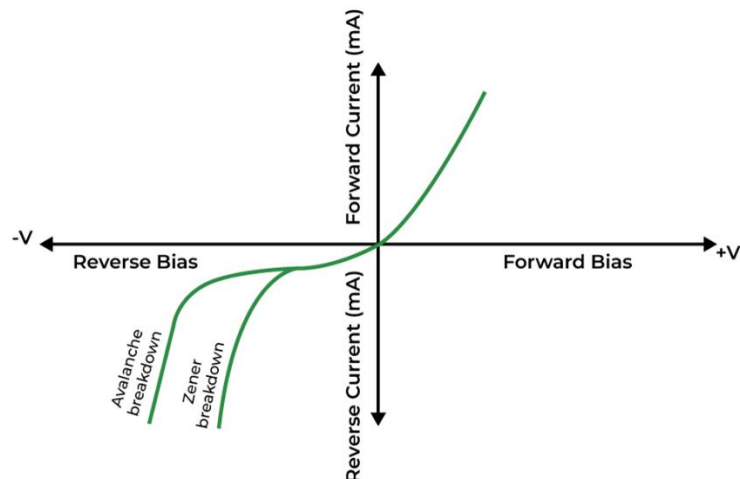
6. Draw the V-I Characteristics of PN Junction.



7. Write the Applications of PN Junction Diode.

- These are used in numerous circuit rectifiers, and varactors for voltage-controlled oscillators.
- While the PN junction diode produces light when biased with a current, hence it is employed in light-emitting diode (LED) and photodiode applications.
- In power electronics engineering, it can be employed in solar cells.
- It is employed in the detector as well as the demodulator circuit thus it can be used as a detector for the demodulation circuit.
- The voltage across the PN junction diode is used to produce temperature sensors and reference voltages.

8. Draw the VI Characteristics of Zener Diode



9. When does a transistor act as a switch?

A transistor should be operated in saturation and cut off regions to use it as a switch. While operating in saturation region, transistor carry heavy current hence considered as ON state. In cut-off, it carries no current and it is equivalent to open switch.

10. Why transistor is called current controlled device?

The output voltage, current or power is controlled by the input current in a transistor. So it is called the current controlled device.