1. Which type of semiconductor material forms covalent bonds between atoms?
a) Elemental semiconductor
b) Compound semiconductor
c) Ionic semiconductor
d) Metallic semiconductor

Answer: a) Elemental semiconductor
Explanation: Elemental semiconductors like silicon and germanium form covalent bonds between atoms, where electrons are shared between neighboring atoms, creating a stable crystal lattice structure.

2. What is the energy band structure of an intrinsic semiconductor?
a) Fully filled valence band, empty conduction band
b) Empty valence band, fully filled conduction band
c) Partially filled valence band, partially filled conduction band
d) Fully filled valence band, partially filled conduction band

Answer: c) Partially filled valence band, partially filled conduction band
Explanation: In an intrinsic semiconductor, the valence band is partially filled with electrons, and the conduction band is partially filled with holes, allowing for some conductivity at room temperature.

3. Which type of charge carriers dominate in an n-type semiconductor?
a) Electrons
b) Holes
c) Protons
d) Neutrons

Answer: a) Electrons
Explanation: In an n-type semiconductor, the majority charge carriers are electrons, which are introduced through the doping process with donor impurities like phosphorus or arsenic.

4. What happens to the depletion region width in a forward-biased diode?
a) Increases
b) Decreases
c) Remains constant
d) Fluctuates randomly

Answer: b) Decreases
Explanation: In a forward-biased diode, the depletion region width decreases as the external voltage applied across the diode opposes the built-in potential barrier, allowing current to flow through the diode.

5. Which diode exhibits a negative resistance region in its characteristic curve?
a) Tunnel diode
b) Schottky diode
c) Varactor diode
d) Zener diode

Answer: a) Tunnel diode
Explanation: Tunnel diodes exhibit a region of negative differential resistance in their characteristic curve, making them useful in microwave and switching applications.

6. What is the primary mechanism of current flow in a photodiode?
a) Injection of minority carriers

b) Reverse saturation current
c) Electron-hole recombination
d) Avalanche breakdown

Answer: c) Electron-hole recombination
Explanation: In a photodiode, incident photons create electron-hole pairs, leading to electron-hole recombination and resulting in a flow of current proportional to the incident light intensity.

7. Which semiconductor device converts light energy directly into electrical energy?
a) Solar cell
b) LED
c) Tunnel diode
d) Zener diode

Answer: a) Solar cell
Explanation: Solar cells convert sunlight directly into electrical energy through the photovoltaic effect, where photons absorbed by the semiconductor material create electron-hole pairs, generating a voltage.

8. What is the main application of a varactor diode?
a) Rectification
b) Voltage-controlled capacitance
c) Light emission
d) Voltage regulation

Answer: b) Voltage-controlled capacitance

Explanation: Varactor diodes, also known as varicap diodes, are primarily used as voltage-controlled capacitors in tuning circuits and voltage-controlled oscillators.

9. Which type of junction is formed in a Schottky diode?
a) p-n junction
b) Metal-semiconductor junction
c) Schottky-barrier junction
d) Tunnel junction

Answer: b) Metal-semiconductor junction
Explanation: A Schottky diode is formed by the junction between a metal electrode and a semiconductor material, creating a barrier to electron flow at the metal-semiconductor interface.

10. What is the breakdown mechanism in a Zener diode?
a) Avalanche breakdown
b) Tunneling breakdown
c) Thermal breakdown
d) Schottky breakdown

Answer: a) Avalanche breakdown
Explanation: Zener diodes operate based on the principle of avalanche breakdown, where a high reverse-bias voltage causes a rapid increase in carrier multiplication, leading to a sharp decrease in resistance and allowing current to flow in the reverse direction.

11. Which diode exhibits a capacitance that varies with the applied voltage?
a) Tunnel diode

b) Varactor diode
c) Zener diode
d) Schottky diode

Answer: b) Varactor diode
Explanation: Varactor diodes exhibit a capacitance that varies with the applied voltage across the diode, making them useful in voltage-controlled oscillator and tuning circuit applications.

12. What is the primary function of a photodetector?
a) Emit light
b) Amplify electrical signals
c) Detect light and convert it into electrical signals
d) Regulate voltage

Answer: c) Detect light and convert it into electrical signals
Explanation: Photodetectors are semiconductor devices that detect incident light and convert it into electrical signals, enabling applications such as optical communication and light sensing.

13. Which semiconductor device emits light when forward biased?
a) Solar cell
b) Tunnel diode
c) LED
d) Zener diode

Answer: c) LED
Explanation: Light Emitting Diodes (LEDs) emit light when forward biased, converting

electrical energy into visible light through the process of electroluminescence.

14. What is the primary mechanism of operation in a tunnel diode?
a) Avalanche breakdown
b) Quantum tunneling
c) Zener breakdown
d) Photoelectric effect

Answer: b) Quantum tunneling
Explanation: Tunnel diodes operate based on the principle of quantum tunneling, where electrons tunnel through a thin barrier in the diode's structure, allowing for high-speed switching and oscillation.

15. Which semiconductor device is used to rectify alternating current (AC) into direct current (DC)?
a) Tunnel diode
b) Photodiode
c) Zener diode
d) Rectifying diode

Answer: d) Rectifying diode
Explanation: Rectifying diodes, commonly known as diodes, are used to convert alternating current (AC) into direct current (DC) by allowing current flow in one direction while blocking it in the opposite direction.

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