1. Which phenomenon is primarily responsible for electron emission in Field Emission Nano MOSFETs?

a) Photoelectric effect
b) Quantum tunneling
c) Fowler-Nordheim tunneling
d) Thermionic emission

Answer: c) Fowler-Nordheim tunneling
Explanation: Field emission nano MOSFETs rely on Fowler-Nordheim tunneling, where electrons tunnel through a potential barrier under the influence of a strong electric field.

2. What is the main mechanism responsible for current flow in a Double Barrier Tunneling device?

a) Thermionic emission
b) Quantum tunneling
c) Phonon-assisted tunneling
d) Field emission

Answer: b) Quantum tunneling
Explanation: Double Barrier Tunneling devices operate based on the principle of quantum tunneling, where electrons penetrate potential barriers due to their wave-like nature.

3. In a Scanning Tunneling Microscope (STM), imaging is achieved through:

a) Electron beam deflection
b) Magnetic resonance

c) Tunneling current variation
d) Optical interference

Answer: c) Tunneling current variation
Explanation: STM relies on measuring the tunneling current between a sharp probe and a sample surface, which varies with the distance between them, providing atomic-scale imaging.

4. Which device utilizes the concept of resonant tunneling for its operation?

a) Light-emitting diode (LED)
b) Field Effect Transistor (FET)
c) Resonant Tunneling Diode (RTD)
d) Metal-oxide-semiconductor (MOS) capacitor

Answer: c) Resonant Tunneling Diode (RTD)
Explanation: RTD operates by exploiting the phenomenon of resonant tunneling through a quantum well, leading to highly nonlinear current-voltage characteristics.

5. FinFETs are characterized by:

a) Increased gate capacitance
b) Reduced gate leakage
c) Larger drain-source resistance
d) Lower transconductance

Answer: b) Reduced gate leakage
Explanation: FinFETs feature a three-dimensional fin structure, which helps to control gate

leakage and improve electrostatic control over the channel.

6. Charge quantization in Single Electron Devices arises due to:

a) Quantum confinement
b) Coulomb blockade
c) Doping concentration
d) Dielectric breakdown

Answer: b) Coulomb blockade
Explanation: Charge quantization in Single Electron Devices occurs because of the Coulomb blockade effect, where the addition or removal of individual electrons is controlled by electrostatic forces.

7. Energy quantization in Single Electron Devices is primarily governed by:

a) Electron spin
b) Electron mass
c) Electrostatic potential
d) Magnetic field

Answer: c) Electrostatic potential
Explanation: Energy quantization in Single Electron Devices is predominantly determined by the electrostatic potential energy within the device, which confines electrons to discrete energy levels.

8. The primary limitation of nanoscale MOSFETs is:

a) Gate oxide breakdown
b) Channel length modulation
c) Subthreshold leakage
d) Thermal resistance

Answer: c) Subthreshold leakage
Explanation: Subthreshold leakage current becomes a significant limitation in nanoscale MOSFETs, impacting their power consumption and overall performance.

9. Which effect is crucial for the operation of Hot Electron devices?

a) Phonon scattering
b) Impact ionization
c) Thermionic emission
d) Electron-phonon coupling

Answer: b) Impact ionization
Explanation: Hot Electron devices rely on impact ionization, where high-energy electrons collide with atoms, generating electron-hole pairs, leading to amplification or switching effects.

10. What phenomenon is responsible for energy dissipation in nano MOSFETs during operation?

a) Electron tunneling
b) Phonon emission
c) Electromagnetic radiation
d) Joule heating

Answer: d) Joule heating

Explanation: Energy dissipation in nano MOSFETs primarily occurs through Joule heating, where resistive losses lead to the conversion of electrical energy into heat.