

Advanced Nanotechnology Principles

Nanotechnology · Practice Test · 8 Questions

1. Which phenomenon describes the transition where electronic, optical, and magnetic properties of materials deviate from bulk behavior as dimensions approach the nanoscale?

- A) Quantum confinement
- B) Superconductivity
- C) Thermal expansion
- D) Surface tension

2. In the context of carbon allotropes, what is the specific hybridization state of carbon atoms in a single-walled carbon nanotube?

- A) sp
- B) sp²
- C) sp³
- D) dsp²

3. Which top-down nanofabrication technique utilizes a focused beam of charged particles to remove material from a substrate with sub-10 nanometer precision?

- A) Photolithography
- B) Focused Ion Beam (FIB) milling
- C) Atomic Layer Deposition
- D) Self-assembly

4. What is the primary reason gold nanoparticles exhibit a deep red or purple color compared to the characteristic yellow of bulk gold?

- A) Localized Surface Plasmon Resonance
- B) Changes in chemical oxidation state
- C) Refraction of light in vacuum
- D) Quantum tunneling

5. Which analytical instrument is capable of manipulating individual atoms to create nanostructures by using a sharp conducting tip and quantum tunneling currents?

- A) Scanning Electron Microscope
- B) Transmission Electron Microscope
- C) Scanning Tunneling Microscope
- D) X-ray Diffraction

6. What is the primary thermodynamic driving force behind the 'bottom-up' self-assembly of block copolymers into nanostructures?

- A) Minimization of Gibbs free energy
- B) Increase in gravitational potential energy
- C) Uniform distribution of kinetic energy
- D) Constant entropy change

7. Which material property is primarily responsible for the increased catalytic efficiency of metal nanoparticles?

- A) High surface-area-to-volume ratio
- B) Increased bulk density
- C) Electrical conductivity
- D) Magnetic permeability

8. What defines the critical length scale in 'nanotechnology' as defined by the ISO/TC 229 technical committee?

- A) 1 to 100 nanometers
- B) 1 to 500 nanometers
- C) 10 to 1000 nanometers
- D) 0.1 to 10 micrometers