

Q. P. Code : **50188**
[Total Marks : 100

(3 Hours)

SECTION-I (max marks: 40)

- N.B.
1. Attempt **All** questions
 2. There are 40 questions in this section and each carries **one** mark
 3. There is only **one** correct answer to each question and **no** negative marking
 4. Please write question no. and your answer (alphabet only) next to it (eg. 5-d)
 5. Scientific calculator is allowed.
 6. Symbols have usual meaning unless stated otherwise.

Question: I

1. A Frenkle defect is an example of
 - a) Point defect
 - b) Line defect
 - c) Dislocations
 - d) None of the above
2. Effect related with the heating/cooling at the junctions of two dissimilar metals is ..
 - a) Peltier effect
 - b) Seebeak effect
 - c) Joules effect of cooling
 - d) Joules-Thompson effect
3. Quantum mechanical term for lattice vibration is
 - a) Photon
 - b) Phonon
 - c) Electron Phonon Coupling
 - d) Atom-Atom coupling
4. If an electron is accelerated to energy of 100 eV then the wavelength associated is
 - a) 12.3 nm
 - b) 12.3 pm
 - c) 1.23 pm
 - d) 1.23 nm
5. Crompton scattering is an example of ...
 - a) Elastic scattering
 - b) Inelastic scattering
 - c) Conservative scattering
 - d) Non-conservative scattering
6. Which of these consumer products is already being made using nanotechnology methods?
 - a) Fishing lure
 - b) Golf ball
 - c) Sunscreen lotion
 - d) All of the above
7. Which one of these statements is NOT true?
 - a) Gold at the nanoscale is red
 - b) Copper at the nanoscale is transparent
 - c) Silicon at the nanoscale is an insulator
 - d) Aluminum at the nanoscale is highly combustible

PE-Con.1076-16.

[TURN OVER

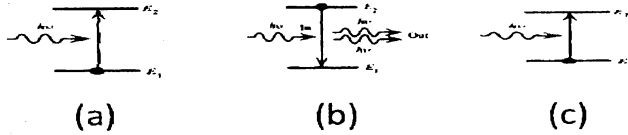
8. Plasmonics is...
- A field of nanophotonics that holds the promise of molecular-size optical device technology
 - The science of fluorescent nanoparticles used in modern fireworks
 - A hypothetical science used in science fiction weaponry (plasma cannons)
 - The technology used to design and build the laser-guided photonic gyroscopes used in aviation.
9. What is a 'self-assembled monolayer'?
- Atoms or molecules that spontaneously form uniform single layers
 - A type of clothing that gets thicker in response to colder temperatures
 - An optical device that puts itself together
 - A fuzzy logic circuit
10. Optical tweezers...
- Are used to remove facial hair with miniaturized laser beams
 - Use light to manipulate particles as small as a single atom
 - Are a nanotechnology-based tool for stamp collectors
 - Don't exist
11. Work function of a tungsten metal is ---
- 4.55 Volts
 - 4.33 Volts
 - 5.12 Volts
 - 4.28 Volts
12. A body centered cubic (BCC) lattice has ----- atoms per primitive cell.
- 1
 - 2
 - 4
 - None of the above
13. The 2θ -ray diffraction pattern recorded using Cu K_α wavelength shows the diffraction peak positioned at ----- $^\circ$ has the inter planer spacing value of 2.602 Angstrom.
- 34.4°
 - 24.5°
 - 17.2°
 - None of the above
14. In case of electron beam evaporator, electrons are generated using the principle of
- Thermionic emission
 - Field emission
 - Photocurrent
 - None of the above
15. The photoionization process of O_2 can be presented as follows
- $O_2 + hv \rightarrow O + O^+ + e^-$
 - $O_2 + hv \rightarrow 2O^+ + 2e^-$
 - $O_2 + hv \rightarrow O^{++} + 2e^-$
 - None of the above
16. A transmission spectra recorded for a semiconductor material shows a strong absorption edge at 540 nm, hence the band gap energy associated with the material in eV is
- 5.3
 - 2.2

- c)2.6
d)1.2
17. In many of the carbon allotropes, graphite is and C_{60} is
- a) metal and semiconductor
b) semimetal and semiconductor
c) semiconductor and metal
d) semiconductor and semimetal
18. is the most stable allotrope of carbon.
- a) Diamond
b) CNT
c) C_{60}
d) Graphite
19. In case of atomic force microscopy when the tip-surface force is maximum the operation mode is known as
- a) Noncontact mode
b) Contact mode
c) None of the above
d) Normal mode
20. Which of the following do not have any magnetic lenses
- a) Transmission electron microscope
b) Scanning electron microscope
c) Tunneling electron microscope
d) None of the above
21. Population inversion term is used in
- a) Lasers
b) Light emitting diodes
c) Transistors
d) Field effect transistors
22. The resistivity of the wire depends on
- a) Diameter and length
b) Length and density
c) Density
d) None of the above
23. The average diameter of a human hair is
- a) 100 micron
b) 20 micron
c) 200 micron
d) 300 micron
24. NOR gate with two inputs is the digital logic gate which implements logical NOR. When its output is high i.e. 1 ?
- a) Both inputs are low i.e. 0
b) One input is low (0) and the other is high (1)
c) Both inputs are high i.e. 1
d) None of the above
25. The law denying existence of monopole is
- a) Magnetic, Gauss law
b) Electric, Faradays Law
c) Magnetic, Maxwell's Law
d) Gravitational, Newton's Law
26. In electromagnetic spectrum the microwave comes in between following bands
- a) Infrared and Radio
b) X-rays and Infrared
c) Ultraviolet and Infrared
d) None of the above

27. has the highest thermal conductivity reported till now.

- a) Copper
b) Gold
c) Graphene
d) Graphite

28. Which of the following schematic represents a stimulated emission process



29. In molecular spectra the vibrational modes are absorbsregion.

- a) UV-VIS (100-500 nm)
b) Infrared (2-100 μm)
c) Microwave (1-10 cm)
d) None of the above

30. Hall measurements can give following information of your sample

- a) Carrier Concentration
b) Mobility
c) Type of carrier
d) All the above

31. The amount of heat released is proportional to the square of the current is known as

- a) Joule heating
b) Ohmic heating
c) Resistive heating
d) All the above

32. In quantum mechanics the Uncertainty principle is given as

- a) $\Delta x. \Delta p_x \geq \frac{h}{2}$
b) $\Delta E. \Delta t \geq \frac{h}{2}$
c) a and b both
d) None of the above

33. In n-type semiconductors Fermi energy level close to

- a) Conduction band
b) Valence band
c) Can't say
d) All the above

34. Following are primary factors causes nanomaterials to behave different than the bulk materials

- a) Surface effect
b) Quantum effect
c) None of the above
d) All the above

35. The fraction of atoms at the surface is called as

- a) Dispersion
b) Diffusion
c) Hopping
d) Adsorption

36. Cohesive energy is

- a) The bond energy per atom
b) Band gap energy associated with atom
c) Bond length per atom
d) None of the above

37. Nanomaterials are defined as a set of substances where at least one dimension is less than nm
- a) 1000
b) 100
c) 10
d) 1
38. Nanotubes, nanorods, nanobelts and nanowires are
- a) 1-D nanomaterials
b) 2-D nanomaterials
c) 0-D nanomaterials
d) All the above
39. The optical properties observed in metallic nanostructures are due to
- a) Energy level spacing
b) Surface Plasmon resonance
c) Phonon interaction
d) Phonon-electron interaction
40. He has how many stable form of isotope
- a) Two
b) Three
c) Six
d) Four

SECTION II (Max. Marks: 30)

- N.B. 1. Attempt any **three** questions
2. All question carry equal marks

1. Explain principle of the vapour condensation process along with the schematics occurs during the plasma processing for nanoparticles synthesis.
2. Explain crystal structure of carbon allotropes.
3. Draw schematics for wet etching observed when Si substrate with the orientation $\langle 100 \rangle$, $\langle 110 \rangle$ and $\langle 111 \rangle$ is used.
4. Define three main criteria for an electron source considered for the use electron beam lithography.
5. Define surface to volume ratio of a sphere?

SETCION III (Max. Marks: 30)

- N.B. 1. Attempt any **two** questions
2. All question carry equal marks

1. If the de-Broglie wavelength of a particle is 6.63×10^{-34} m, calculate the weight and velocity associated with it.
 2. What is the role of following modules in X-ray diffraction system and specify its position in the system with schematic diagram
 - a) Collimator
 - b) Monochromator
 - c) Slits
 - d) Goniometer
 - e) X-ray tube
 3. Explain any five type of nano-devices based on nanomaterials properties.
 4. Explain the different type of nanotubes based on their structural ordering.
-