

Roll No.

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**M.Sc. (Fourth Semester)
EXAMINATION, May - June, 2022
PHYSICS
Paper Fourth (C)
(PHYSICS OF NANOMATERIALS-II)**

Time : Three Hours]

[Maximum Marks:80

Note: Attempt all sections as directed.

(Section-A)

(Objective/Multiple Choice Questions)

(1 mark each)

Note: Attempt all question:

Choose the correct answer-

1. The density of states in quantum wire varies with energy (E) as-

- (A) E
- (B) $E^{1/2}$
- (C) $E^{-1/2}$
- (D) Constant

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2. When size is reduced to nanometer range, electrical conductivity-
- (A) increases
 - (B) decreases
 - (C) remains same
 - (D) varies randomly
3. When two quantum wells are separated by a barrier of small width, the energy levels in each quantum well-
- (A) remains unchanged
 - (B) shifts to higher energy
 - (C) split into 4 levels
 - (D) split into 2 levels
4. A polaron is a quasi-particle associated with interaction between-
- (A) charge carrier and lattice vibrations
 - (B) charge carrier and polarization
 - (C) photons with lattice vibrations
 - (D) photons with charge carriers
5. What is the general name for the class of structures made of rolled up carbon lattices?
- (A) nanosheets
 - (B) nanotubes
 - (C) nanorods
 - (D) Fulleroles

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6. Compressive strength of nanotube is _____ its tensile strength.
- (A) less than
 - (B) greater than
 - (C) equal to
 - (D) none of these
7. Which one of the following is used in solar cells?
- (A) nanorods
 - (B) nanobots
 - (C) fullerene
 - (D) carbon nanotubes
8. What is the advantage of using nano-carbon tubes?
- (A) high speed
 - (B) less energy consumption
 - (C) high memory capacity
 - (D) all the above
9. Nano sized polymers built from branched units are called-
- (A) dendimers
 - (B) blends
 - (C) composites
 - (D) co-polymers

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10. Which one of the following is used in cancer therapeutics?
- (A) carbon nanotubes
 - (B) nanobots
 - (C) bucky balls
 - (D) nanoclusters
11. Carbon nanotubes are poor transmitters of electromagnetic radiations due to their
- (A) high porosity
 - (B) large surface area
 - (C) high conductivity
 - (D) chemical stability
12. How nanotechnology is used in medical community?
- (A) testing and diagnosis only
 - (B) tissue engineering only
 - (C) drug delivery only
 - (D) all the above
13. Lithography is a-
- (A) top down technique
 - (B) bottom up technique
 - (C) hybrid technique
 - (D) none of these

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14. In photo-lithography, finer resolution can be obtained using
(A) red light
(B) blue light
(C) UV radiations
(D) X-rays
15. Which of the following is true for photo lithography photoresist (PR)
(A) negative PR is hardened by UV radiations
(B) negative PR is softened by UV radiations
(C) positive PR is hardened by UV radiations
(D) both positive and negative PR work in same way
16. The initial tools used to help launch nanoscience revolution were-
(A) microscopes
(B) binoculars
(C) interferometers
(D) scanning probe instruments
17. Which of the following processes of material is not described as nanotechnology?
(A) consolidation
(B) separation
(C) creation
(D) lithography

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18. Which property of nanomaterials make them suitable for elimination of pollutants?
(A) high purity
(B) better thermal conductivity
(C) enhanced chemical reactivity
(D) small size
19. Which one of the following is an advantage of nanotechnology?
(A) increased stability
(B) low solubility
(C) leakage of drug
(D) all the above
20. Which one of the following is two dimensional nanomaterial?
(A) colloids
(B) thin layers
(C) whiskers
(D) clusters

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(Section-B)

(2 marks each)

(Very Short Answer Type Questions)

Note: Attempt all question :

1. Explain crystal bonding.
2. What is polaron conduction?
3. How CNT are used in fuel cells?
4. What is tissue engineering?
5. Give difference between electron beam lithography (EBL) and STM based EBL.
6. What is meant by sustainable nanotechnology?
7. Explain use of CNT in tissue repair.
8. Explain environmental surveillance.

(Section-C)

(Short Answer Type Questions)

(3 marks each)

Note : Attempt all question :

1. Explain field enhanced thermoionic emission.
2. Explain how functional nanomaterials can be used for clean environment.
3. Discuss use of poloneric nanofibers for medical prostheses.
4. Explain filtration applications of polymeric nanofibers.

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5. Describe phase shifting optical lithography.
6. What are proximal probes? Explain.
7. Discuss the impacts of nanomaterials on environment.
8. Explain eco-toxicology.

(Section-D)

(Long Answer Type Questions)

(5 marks each)

Note: Attempt any *four* question.

1. Discuss band structure and density of states at nanoscales in various dimensions.
2. Describe use of carbon nanotubes (CNT) in LED and flat panel displays.
3. Explain optical applications of polymeric nanofibers. In which sensor devices these can be used?
4. What do you mean by nanolithography? Give its importance and describe soft lithography.
5. Discuss threat posed by nanomaterials to human beings and environment. What preventive measures are required?
6. Discuss various conduction mechanisms in 3D, 2D and low dimension systems.