| Seat No. | |
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**PD-40**

**Total No. of Pages : 10**

# Ph.D. Entrance Examination-2025
# Subject- Nanoscience and Technology,
# BOS-88 (BOS in Ph.D. Entrance)
# Sub. Code: 81175

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**Day and Date : Wednesday, 10-09-2025** **Total Marks : 100**

**Time : 1.00 p.m. to 3.00 p.m.**

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**Instructions:**

1. All questions are compulsory.
2. Each question carries 2 marks.
3. Answers should be marked in the given OMR answer sheet by darkening the appropriate option.
4. Use black ball point pen only for marking the circle. Do not make any stray mark on the OMR Answer Sheet.
5. Follow the instructions given on OMR Sheet.
6. Rough work shall be done on the sheet provided at the end of question paper.
7. Only non programmable calculators are allowed.

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1) Literature survey provides answers to which of the following questions?

   a) Who is the pioneer in your research area?

   b) Which are the key or popular papers/review articles in this field?

   c) Which papers belong to or matches with your project?

   d) All of the above

2) In the synopsis "The motivation of the research area" can be mentioned under

   a) Introduction b) Objectives.

   c) Significance of research d) Literature survey

3) What is wrong to mention the cover letter

   a) Speak negatively about other studies or researchers

   b) History of the manuscript

   c) Independent reviewers suggestion (or exclusion)

   d) Explain briefly the specific advances over previous research and potential applications

4) Descriptive research includes .....and fact-finding enquiries of different kinds.

a) Hypothesis b) Research papers

c) Surveys d) Problems

5) Quantitative research is based on the ..... measurements of some characteristics.

a) Qualitative b) Quantitative

c) Qualitative or quantitative d) Qualitative and quantitative

6) Research methodology is a way to systematically solve the.....

a) Problems

b) Day today problem

c) Research problem

d) Any problem

7) Working hypothesis is tentative ..... made in order to draw out and test its logical or empirical consequences.

a) Solution b) Problem

c) Diagram d) Assumption

8) In research process, the first step and foremost step is .....

a) Selecting and properly defining a research problem

b) Surveying the literature

c) Understanding the nature of problem

d) Rephrasing the research problem

9) When a prediction or a hypothesized relationship is to be tested by scientific methods, it is termed as .....

a) Research methodology b) Research hypothesis

c) Research design d) Research outcome

10) ..... of data is a process of examining the collected raw data to detect errors, omissions and to correct these when possible.

a) Coding b) Classification

c) Editing d) Analysis

11) The QD has ..... number of dimensions confined

a) 0 b) 1

c) 2 d) 3

12) Due to the surface area to volume ratio which factor is affected significantly

a) Reactivity b) Absorption

c) Conductivity d) Magnetism

13) In single electron transistor .....effect was observed

a) Coulomb blockade b) Quantum confinement

c) Surface to volume ratio d) None of the above

14) In which of the following option the quantum tunnelling effect is absent

a) Single electron transistor b) Esaki diode

c) Atomic force microscopy d) SWCNT

15) In Maxwell Bridge the balance equation is independent of .....

a) Resistance b) Capacitance

c) Frequency d) Charge

16) Kelvin's bridge is used for measurement ..... Resistance.

a) Low b) High

c) Medium d) Very High

17) A basic bridge consist of ..... arms

a) One b) Three

c) Four d) Two

18) The absorbance is inversely proportional to the ..... of the solution

a) Concentration b) Path length

c) Transmittance d) Absorptivity

19) The Raman Effect is a ..... process

a) Diffraction b) Elastic Scattering

c) Inelastic Scattering d) Interference

20) When a capillary tube is dipped in a liquid, then the level of the liquid inside the tube rises because of .....

a) viscosity b) surface tension

c) osmosis d) diffusion

21) The lotus leaf is an example of ..... surface.

a) hydrophilic b) hydrophobic

c) superhydrophilic d) superhydrophobic

22) Find curl $\vec{F}$ for the vector field $\vec{F} = 3x^2\ \hat{\imath} + 2Z\ \hat{\jmath} - x\ \hat{k}$

a) $5\ \hat{\imath} - 4\ \hat{\jmath} - x\ \hat{k}$ b) $-2\ \hat{\imath} + \hat{\jmath}$

c) 6x d) $--2\ \hat{\imath} - \hat{\jmath}$

23) The particles which obey Pauli's exclusion principle are.....

a) Classical particles b) Quantum particles

c) Bosons d) Fermions

24) According to quantum statistics, size of cell should not be less than .....

a) $h^3$ b) $h^2$

c) h d) h/2

25) Atwood's machine is an example of conservative system with.....constraints.

a) Holonomic, rheonomous

b) Holonomic, scleronomous

c) Holonomic, non Holonomic

d) Non Holonomic, scleronomous

26) .....is correct form of D'Alembert's principle.

a) $\Sigma(F_i^a + \dot{P}_i)\delta r_i = 0$ b) $\Sigma(F_i^a + p_i)\delta r_i = 0$

c) $\Sigma(F_i^a - \dot{P}_i)\delta r_i = 0$ d) $\Sigma(F_i^a - p_i)\delta r_i = 0$

27) Shortest distance between two point in plane have .....path.

a) Cycloid b) Elliptic

c) Semi cycloid d) Straight line

28) In case of modified Hamilton's principle, the path refers to

a) Configuration space b) Phase space

c) Position space d) All of these

29) In quantum mechanics, the raising operator is given by.....

a) $L_+ = L_x + iLy$ b) $L. = L_x - iL_y$

c) $L. = L_z + iL_y$ d) $L. = L_z - iL_y$

30) Exfoliation is a method to make graphene by.....

a) Lifting off graphene layers from a large graphite crystals

b) Extracting the top most Si atoms from a perfect SiC surface leaving graphene on the top

c) Synthesizing carbon atoms on polymer foils

d) Depositing carbon on metal foils

31) To be classed as "nanoscale", an object must have one dimension that is of the order of .....

a) $10^{-10}$ m b) $10^{-12}$ m

c) $10^{-9}$m d) $10^{-15}$ m

32) Bonding between the layers of graphene is .....

a) Strong b) Weak

c) Very tightly bonded. d) Not bonded

33) Which of the following is an example of bottom-up approach for the preparation of nanomaterials?.

a) Etching b) Dip pen nano-lithography

c) Lithography d) Erosion

34) The properties like melting point, solubility, color, etc changes on varying the

a) Size b) Composition

c) Surface properties d) None of the mentioned

35) The properties like dispersibility, conductivity, ete changes on varying the

a) Size b) Composition

c) Surface properties d) None of the mentioned

36) Quantum confinement results in

a) Energy gap in semiconductor is proportional to the inverse of the square root of size

b) Energy gap in semiconductor is proportional to the inverse of the size

c) Energy gap in semiconductor is proportional to the square of size

d) Energy gap in semiconductor is proportional to the inverse of the square of size

37) In field emission display, carbon nanotubes are used as ..... material.

a) Anode b) Cathode

c) Spacer d) Display

38) Semiconductor-metal junction solar cells are also know a .....

a) Sensitized solar cells b) Photoelectrochemical cells

c) Wet chemical solar cells d) Schottkey barrier cell

39) The yeast that is used in alcohol production and bread making is

*a) Escherichia coli* *b) Saccharomyces cerevisiae*

*c) Bacillus subtilis* *d) Pseudomonas putida*

40) MEMS does not necessarily require

a) fluids b) chips

c) transducers d) signals

41) S Layer found in bacteria is made up of

a) phospholipid b) glycoproteins

c) glycolipids d) Liposomes

42) The size of viruses ranges in between

a) 10nm-20nm b) 20nm-300nm

c) 300nm-600mm d) 1nm-10nm

43) Self assembled closed colloidal structures composed of lipid bilayers are called as:

a) Dendimers b) Polymers

c) Micelles d) Liposomes

44) PNA stands for

a) Protein Nucleotide b) Peptide Nucleic Acid

c) Peptide Nucleotide d) Peptide Nuclease acid

45) Nanodevices use .....to move linearly by motion.

a) ATP b) Electricity

c) motor proteins d) ADP

46) 'Nacre' are produced by

a) Bacteria b) Fungus

c) Molluscs d) Virus

47) The sources used in modern Raman spectrometry are nearly always.....

a) Xenon Lamp b) Polychromatic source

c) LASER d) Tungsten Filament Lamp

48) The intensity of absorption band is always proportional to.....

a) Atomic population

b) Molecular population of initial state

c) Molecular population of final state

d) Molecular population of intermediate state

49) The distance of a complex number z = 3i from the origin is .....

a) 3 units b) 2 units

c) 1 unit d) 1.5 units

50) The partial derivative of z= sin(xy) w.r.t. x is

a) cos (xy) b) cos(xy)

c) y cos(xy) d) -y cos(xy)

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**- Rough Work -**

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