

Seat No.

Total No. of Pages : 20

M.Sc. Entrance Examination 2026
School of Nanoscience and Biotechnology
Sub. Code: 71144

Day and Date : Tuesday, 21/07/2026**Total Marks : 100****Time : 10:30 am to 12:00 pm**

Instructions:

- 1) All questions are compulsory.
 - 2) Each question carries 1 mark.
 - 3) Answers should be marked in the given OMR answer sheet by darkening the appropriate option.
 - 4) Follow the instructions given on OMR sheet.
 - 5) Rough work shall be done on the sheet provided at the end of question paper.
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Q. 1 Select the most correct alternative.

1. The "bottom-up" approach involves:
 - a. Breaking down bulk material
 - b. Building structures atom by atom
 - c. Using mechanical grinding
 - d. Lithography
2. Nanoparticles are used in sunscreens primarily because they:
 - a. Make it smell better
 - b. Absorb/Scatter UV light efficiently
 - c. Increase the weight
 - d. Change the color to blue

3. CNT stands for:
 - a. Carbon Nano Tissue
 - b. Carbon Nanotubes
 - c. Crystal Nano Tech
 - d. Carbon Nitrogen Total
4. Gold nanoparticles in solution appear red due to:
 - a. Surface Plasmon Resonance
 - b. Oxidation
 - c. Refraction
 - d. Chemical dye
5. Which technique is used to see the topography of a surface at the atomic level?
 - a. AFM (Atomic Force Microscopy)
 - b. UV-Vis
 - c. XRD
 - d. Centrifugation
6. Quantum dots are examples of:
 - a. 1D structures
 - b. 2D structures
 - c. 0D structures
 - d. 3D structures
7. Surface area to volume ratio in nanoparticles is:
 - a. Very high
 - b. Very low
 - c. Zero
 - d. Same as bulk

14. Generalized coordinates must be:
- a. Dependent
 - b. Independent
 - c. Cartesian only
 - d. Polar only
15. According to wave-particle duality, a photon acts as:
- a. Only a wave
 - b. Only a particle
 - c. Both a wave and a particle
 - d. Neither a wave nor a particle
16. For a free particle, the potential energy V is:
- a. Infinite
 - b. Zero
 - c. Negative
 - d. $mg \cdot h$
17. The Schrodinger equation is a:
- a. Wave equation
 - b. Linear algebraic equation
 - c. Relativistic equation
 - d. Static equation
18. As the mass of a particle increases, its de-Broglie wavelength:
- a. Increases
 - b. Decreases
 - c. Remains same
 - d. Becomes infinite

19. Phase velocity is also known as:
- a. Wave velocity
 - b. Particle velocity
 - c. Signal velocity
 - d. Group velocity
20. Ferrofluids contain nanoparticles of:
- a. Magnetic materials
 - b. Transparent glass
 - c. Plastic
 - d. Wood
21. The unattainability of absolute zero is a consequence of:
- a. First Law
 - b. Second Law
 - c. Third Law
 - d. Zeroth Law
22. During a cyclic process, the change in internal energy is:
- a. Zero
 - b. Positive
 - c. Negative
 - d. Infinite
23. Which of the following is a path function?
- a. Temperature
 - b. Work
 - c. Entropy
 - d. Pressure
24. Enthalpy is the sum of internal energy and:
- a. Entropy
 - b. Pressure-volume product
 - c. Temperature
 - d. Chemical potential

25. The ratio of specific heats (C_p/C_v) for a gas is always:
- a. Greater than one
 - b. Less than one
 - c. Equal to one
 - d. Zero
26. An irreversible process leads to:
- a. Increase in entropy of the universe
 - b. Decrease in entropy of the universe
 - c. Constant entropy of the universe
 - d. No change in energy
27. The Carnot cycle consists of:
- a. Two isotherms and two isobars
 - b. Two isotherms and two adiabatics
 - c. Two isochores and two isotherms
 - d. Two isobars and two adiabatics
28. The slope of an adiabatic curve is:
- a. Steeper than an isothermal curve
 - b. Less steep than an isothermal curve
 - c. Same as an isothermal curve
 - d. Horizontal
29. Thermodynamic equilibrium implies:
- a. Thermal equilibrium only
 - b. Mechanical equilibrium only
 - c. Chemical equilibrium only
 - d. All of the above

30. The work done in an isochoric process is:
- a. Zero
 - b. Maximum
 - c. Minimum
 - d. Infinite
31. Which law of thermodynamics is known as the law of conservation of energy?
- a. Zeroth Law
 - b. First Law
 - c. Second Law
 - d. Third Law
32. In an adiabatic process, which of the following remains constant?
- a. Temperature
 - b. Pressure
 - c. Entropy (for reversible cases)
 - d. Volume
33. Which parameter remains constant during an isobaric process?
- a. Temperature
 - b. Pressure
 - c. Volume
 - d. Internal Energy
34. The Zeroth Law of thermodynamics provides the basis for the measurement of:
- a. Pressure
 - b. Work
 - c. Heat
 - d. Temperature
35. For an ideal gas, the internal energy is a function of:
- a. Temperature only
 - b. Volume only
 - c. Pressure only
 - d. Entropy only

36. A heat engine operating between two temperatures cannot be more efficient than a:
- a. Steam engine
 - b. Diesel engine
 - c. Carnot engine
 - d. Otto engine
37. Entropy of a system increases in which type of process?
- a. Reversible
 - b. Irreversible
 - c. Adiabatic reversible
 - d. Isothermal reversible
38. The Second Law of Thermodynamics introduces the concept of:
- a. Internal energy
 - b. Entropy
 - c. Enthalpy
 - d. Work
39. A refrigerator is essentially a:
- a. Heat engine running in reverse
 - b. Device that creates cold
 - c. Perpetual motion machine
 - d. Battery
40. At absolute zero temperature, the entropy of a perfectly crystalline substance is:
- a. Maximum
 - b. Zero
 - c. Infinite
 - d. Negative
41. Which microscope uses an electron beam instead of light?
- a. Optical microscope
 - b. TEM (Transmission Electron Microscope)
 - c. Magnifying glass
 - d. Telescope

42. The primary goal of green nanotechnology is:
- a. To make things green in color
 - b. To minimize environmental and health risks
 - c. To use more energy
 - d. To produce more waste
43. In SEM, "SEM" stands for:
- a. Scanning Electron Microscopy
 - b. Static Electron Motion
 - c. Standard Energy Method
 - d. Signal Electron Mapping
44. Quantum confinement leads to:
- a. Discrete energy levels
 - b. Continuous energy bands
 - c. Lower melting points only
 - d. Increased mass
45. Which nanomaterial is used to create "Superhydrophobic" surfaces?
- a. Silica nanoparticles
 - b. Salt
 - c. Sugar
 - d. Iron filings
46. Using nanoparticles to clean up oil spills is an example of:
- a. Nanoremediation
 - b. Nanolithography
 - c. Nanocircuitry
 - d. Nanofabrication

47. Which of these is a natural nanomaterial?
- a. Steel
 - b. Lotus leaf surface
 - c. Plastic bag
 - d. Glass window
48. The term "Nanotechnology" was first popularized by:
- a. Newton
 - b. Eric Drexler / Richard Feynman
 - c. Einstein
 - d. Bohr
49. Nano-silver is commonly used in:
- a. Wound dressings
 - b. Car tires
 - c. Building bricks
 - d. Lead pencils
50. What happens to the band gap of a semiconductor as the particle size reaches the nano-range?
- a. It decreases
 - b. It increases
 - c. It stays the same
 - d. It disappears
51. Carbon nanotubes are characterized by:
- a. High tensile strength
 - b. High electrical conductivity
 - c. High thermal conductivity
 - d. All of the above

52. Lithography is a:
- a. Bottom-up approach
 - b. Top-down approach
 - c. Chemical synthesis
 - d. Biological synthesis
53. Which property of a material changes at the nanoscale?
- a. Chemical reactivity
 - b. Mechanical strength
 - c. Optical transparency
 - d. All of the above
54. Which nanoparticle is widely used for its antimicrobial properties?
- a. Gold
 - b. Silver
 - c. Silicon
 - d. Iron
55. Nanotoxicology is the study of:
- a. Making better computers
 - b. The toxicity of nanomaterials
 - c. Plant growth
 - d. Star formations
56. In nanotechnology, "CVD" stands for:
- a. Chemical Volume Deposit
 - b. Chemical Vapor Deposition
 - c. Carbon Vapor Design
 - d. Controlled Variable Density

57. What is the scale of nanotechnology?
- a. 1-100 micrometers
 - b. 1-100 nanometers
 - c. 1-100 millimeters
 - d. 1-100 picometers
58. The synthesis method involving a precursor solution undergoing hydrolysis is:
- a. Sol-gel
 - b. CVD
 - c. Ball milling
 - d. Laser ablation
59. Fullerenes (Buckyballs) consist of how many carbon atoms in their most stable form?
- a. 20
 - b. 40
 - c. 60
 - d. 100
60. Targeted drug delivery using nanotechnology helps in:
- a. Increasing side effects
 - b. Reducing toxicity to healthy cells
 - c. Making drugs cheaper
 - d. Increasing the size of the drug
61. The phenomenon of splitting white light into its constituent colors is:
- a. Interference
 - b. Diffraction
 - c. Dispersion
 - d. Polarization
62. Resolving power of an optical instrument is the reciprocal of:
- a. Magnification
 - b. Limit of resolution
 - c. Focal length
 - d. Numerical aperture

63. Which of the following is used to produce plane-polarized light?
- a. Concave lens.
 - b. Nicol prism
 - c. Prism
 - d. Convex mirror
64. Newton's rings are formed due to the phenomenon of:
- a. Interference
 - b. Diffraction
 - c. Polarization
 - d. Dispersion
65. In a Fresnel diffraction, the source and screen are at:
- a. Infinite distance
 - b. Finite distance
 - c. The focal point
 - d. Zero distance
66. The bending of light around the corners of an obstacle is called:
- a. Refraction
 - b. Interference
 - c. Diffraction
 - d. Reflection
67. Which theory treats light as a longitudinal wave (later corrected to transverse)?
- a. Newton's corpuscular theory
 - b. Huygens' wave theory
 - c. Planck's quantum theory
 - d. Maxwell's EM theory
68. Longitudinal chromatic aberration occurs in:
- a. Mirrors
 - b. Lenses
 - c. Prisms
 - d. Gratings

69. The ratio of the sine of the angle of incidence to the sine of the angle of refraction is:
- a. Refractive index
 - b. Power of lens
 - c. Magnification
 - d. Brewster's constant
70. A zone plate acts like a:
- a. Concave mirror
 - b. Converging lens
 - c. Diverging lens
 - d. Plane mirror
71. Oxidation of alkynes with hot KMnO_4 gives.....
- a) Aldehydes
 - b) Carboxylic acids.
 - c) Alcohols
 - d) Alkanes
72. Methane reacts with chlorine in presence of sunlight to give.....
- a) Chloromethane
 - b) Dichloromethane
 - c) Chloroform
 - d) All of these
73. Which of the following is a saturated hydrocarbon?
- a) Ethyne
 - b) Ethene
 - c) Propane
 - d) Benzene
74. Nanocatalysis involves catalysts of size.....
- a) 1-100 nm
 - b) >1000 nm
 - c) <1 nm
 - d) 1 mm

75. Birch reduction produces from aromatic benzenoid rings
- a) 1,4-cyclohexadienes b) cis-alkynes
- c) alkanes d) alcohols
76. Reaction of sodium alkoxide and alkyl halides gives ether, this is known as.....
- a) formation of cyanide
- b) formation of isocyanide
- c) williamsons synthesis
- d) formation of nitro-compound
77. Which alkyl halide reacts fastest in SN^2 reaction?
- a) secondary b) primary
- c) neopentyl d) secondary
78. Aryl halides have the general formula.....
- a) R-OH b) Ar-X
- c) Ar-OH d) R-X
79. Which reagent is used in Sandmeyer reaction to prepare aryl chlorides?
- a) CuCl b) HCl
- c) NaCl d) AlCl_3
80. Reaction of copper powder and halogen acid is known as
- a) Sandmeyer reaction b) gattermann reaction
- c) diazonium salt reaction d) direct halogenation

81. According to Bronsted Lowry theory base is...
- a) Proton acceptor
 - b) Proton donor
 - c) Electron donor
 - d) Electron acceptor
82. The correct formula for molality
- a) Molality kilograms of solute litres of solvent
 - b) Molality moles of solute kilograms of solvent
 - c) Molality kilograms of solute kilograms of solution
 - d) Molality moles of solute moles of solution
83. Rusting of iron occurs due to:
- a) Direct oxidation only
 - b) Formation of anodic and cathodic regions
 - c) Thermal decomposition
 - d) Photochemical reaction
84. Hardness of water is due to:
- a) Na^+ , K^+
 - b) Cl^- , SO_4
 - c) Ca^{2+} , Mg^{2+}
 - d) H^+
85. Stationary phase is:
- a) Fixed phase
 - b) Moving phase
 - c) Gas phase
 - d) Liquid phase

86. Order of reaction is:
- a) Number of molecules
 - b) Rate constant
 - c) Activation energy
 - d) Sum of powers of concentration
87. Octane number measures:
- a) Diesel quality
 - b) Petrol quality
 - c) Lubricant
 - d) Coal
88. Coordinate bond is formed by:
- a) Equal sharing
 - b) Transfer
 - c) Lone pair donation
 - d) Attraction
89. Group II separation based on:
- a) Oxidation
 - b) Size
 - c) Solubility product
 - d) Boiling
90. Chelates form:
- a) Ionic bonds.
 - b) Rings
 - c) Hydrogen bonds
 - d) Weak bonds
91. Aldehyde group:
- a) -COOH
 - b) -OH
 - c) -CHO
 - d) -NH_2

92. Cannizzaro occurs in:
- a) No α -H aldehydes
 - b) Ketones
 - c) Alcohols
 - d) Amines
93. In the galvanic cell, electrical energy is generated as a result of reaction.
- a) Non spontaneous reaction
 - b) Spontaneous reaction
 - c) Nuclear reaction
 - d) None of the above
94. Galvanic cell electric current while electrolytic cell electric current.
- a) Consume, produce
 - b) Consume, consume
 - c) Produce, consume
 - d) Produce, produce
95. Which of the following atmospheric molecules absorb IR radiations?
- a) H_2O Vapors
 - b) O_2
 - c) N_2
 - d) He
96. In which cell electrical energy is converted into chemical energy?
- a) Galvanic cell
 - b) Daniel cell
 - c) Voltaic cell
 - d) Electrolytic cell

97. Carbon dioxide molecule has fundamental vibrational modes.
a) 2
b) 4
c) 5
d) 6
98. In electrolytic cell electrons moves from
a) Ion to ion
b) ion to cathode
c) Anode to cathode through external circuit
d) Cathode to anode through external circuit
99. What is nuclear chemistry?
a) Study of electronic reactions
b) Study of nuclear reactions
c) Study of Biochemical reactions
d) Study of light reactions
100. The spontaneous immersion of radiations by an element is
a) Radioactivity
b) Chemical activity
c) Bioactivity
d) None of the above

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ROUGH WORK