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ENT - 21

Total No. of Pages : 22

PG ENTRANCE EXAMINATION, 2024
NANOSCIENCE AND BIOTECHNOLOGY
Subject Code : 71144

Day and Date : Friday, 17-05-2024

Total Marks : 100

Time : 1.00 p.m. to 2.30 p.m.

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.

1. In a system of N particles subjected to ' K ' independent constraints, the number of degrees of freedom of is.....
 - a) $3N-K$
 - b) $3N+K$
 - c) $3N$
 - d) $3N-2K$

2. A primitive cell is a unit cell that contains
 - a) exactly one and half lattice point
 - b) exactly one lattice point
 - c) exactly two lattice point
 - d) exactly Three lattice point

3. Coordination number in Face Centred Cubic crystal structure
 - a) 6
 - b) 8
 - c) 12
 - d) 14

4. If 'V' is electric field and 'ρ' is the charge density then the Poisson's equation is given by...
 - a) $\nabla^2 \cdot V = \rho/\epsilon_0$
 - b) $\nabla^2 \cdot V = -\rho/\epsilon_0$
 - c) $\nabla^2 \cdot V = 2(\rho/\epsilon_0)$
 - d) $\nabla^2 \cdot V = -3(\rho/\epsilon_0)$

5. If a system has N = 2 number of particles and k = 1 number of constraint equations, then what is the degrees of freedom for this system?
 - a) 2
 - b) 3
 - c) 4
 - d) 5

6. Out of all possible paths of a dynamical system between the time instants to and ty, the actual path followed by the system is one for which the action has a stationary value, this is called as principle.
 - a) Hamilton's
 - b) D'Alembert's
 - c) Lagrangian
 - d) Newton's

7. If 'B' is magnetic field (uniform magnetic field) which is applied perpendicular to the motion of charged particle (along x axis) then the trajectory (path) is...
 - a) Circular
 - b) Elliptical
 - c) Parabolic
 - d) Parallel line

8. Unit for magnetic flux density is

- a) Wh/m²
- b) Wb/A.m
- c) A/m
- d) Tesla/m

9. Example for dia-magnetic materials

- a) super conductors
- b) alkali metals
- c) transition metals
- d) Ferrites

10. Example for ferro-magnetic materials

- a) super conductors
- b) alkali metals
- c) transition metals
- d) Ferrites

11. Viscosity of a gas is due to transport of

- a) momentum
- b) mass
- c) energy
- d) none of these

12. The average kinetic energy associated with each degree of freedom is

- a) kT
- b) 2kT
- c) kT/2
- d) kT/4

13. Joule Thomson effect is based upon

- a) Sudden compression of gases
- b) Cooling of gases
- c) Sudden expansion of gases
- d) Heating of gases

14. Any process in which the system returns to its initial state after undergoing a series of changes is known as
- a) Clockwise process
 - b) Anticlockwise process
 - c) Cyclic process
 - d) Thermodynamic process.
15. The relation between entropy and probability is given by
- a) $S = k \log W$
 - b) $S = k \log W + c$
 - c) $S = \log W$
 - d) $S = k / \log W$
16. Reverberation phenomenon is due to
- a) Multireflection of sound waves in a hall
 - b) Interference of sound waves in a hall
 - c) Diffraction of sound waves in a hall
 - d) Resonance of sound waves in a hall
17. The fundamental mode of vibration of string is nothing but..... mode of vibration.
- a) First harmonic
 - b) first overtone
 - c) first octave
 - d) second harmonic

18. Waves travelling on a string are.....
- a) Transverse waves b) longitudinal waves
- c) pressure waves d) matter waves
19. When a particle is subjected to two simple harmonic oscillations at right angle to each other then it produces.....
- a) Beats b) Lissajous figures
- c) echo d) echo and beats
20. Two simple harmonic oscillations travelling along same line and have slightly different frequencies produce.....
- a) Lissajous figures
- b) beats
- c) both Lissajous figures and beats
- d) neither Lissajous figures nor beats
21. Divergence of magnetic field ($\vec{\nabla} \cdot \vec{B}$) =
- a) 4π b) μJ
- c) Zero d) 2π
22. The susceptibility of magnesium at 300 °K is 1.2×10^{-5} At what temperature will the susceptibility increase to 2×10^{-5} ?
- a) 100°K b) 2000°K
- c) 180°K d) 400°K

23. The magnetic induction B at the centre of circular coil is.....

a) $B_{\text{centre}} = \frac{\mu_0 I}{2R}$

b) $B_{\text{centre}} = \frac{\mu_0 I}{R}$

c) $B_{\text{centre}} = \frac{\mu_0}{2R}$

d) $B_{\text{centre}} = \frac{\mu_0 I}{4R}$

24. The magnetic induction B of a straight conductor having infinite length carrying a steady current I is.....

a) $B = \frac{\mu_0 I}{R}$

b) $B = \frac{\mu_0 I}{2\pi R}$

c) $B = \frac{\mu_0}{6R}$

d) $B = \frac{\mu_0}{2\pi R}$

25. Owen's bridge is balanced when the value of resistance $R_1 = 520 \Omega$. The value of resistance $R_4 = 700 \Omega$ and the capacitor $C_2 = 0.1 \mu\text{F}$.

Calculate the value of inductance L.

a) 37.8 mH

b) 34.8 mH

c) 36.4 mH

d) 40 mH

26. If the surface tension of a soap bubble is "T" then the excess pressure inside its bubble of radius 'r' is.....

a) $(4T)/r$

b) $(T)/r$

c) $(2T)/r$

d) $(6T)/r$

27.law states that "The induced emf is always such that it opposes the change that produces it".

- | | |
|-------------|--------------|
| a) Lenz's | b) Faraday's |
| c) Newton's | d) Ampere's |

28. Unit for mutual inductance in S. I. system is.....

- | | |
|-----------|----------|
| a) Ampere | b) Volt |
| c) Ohm | d) Henry |

29. The acceleration of a spherical shell, rolling down an inclined plane is

- a) $(3/5) g \sin\theta$
- b) $(2/5) g \sin\theta$
- c) $(7/5) g \sin\theta$
- d) $(9/5) g \sin\theta$

30. Dimensions of gravitational constant (G) =

- a) $[M^1L^2T^3]$
- b) $[M^{-1}L^2T^{-3}]$
- c) $[M^1L^2T^3]$
- d) $[M^1L^{-2}T^{-3}]$

31. The orbital is identified byquantum numbers.

- | | |
|------|------|
| a) 1 | b) 2 |
| c) 3 | d) 4 |

44. Which of the following metals can displace the rest from their salt solutions?

- (a) Copper (b) Zinc
(c) Silver (d) More than one of the above

45. Carboxylic acid cannot be obtained by oxidation of.....

- (a) aldehyde (b) ketone
(c) Alkyl benzene (d) nitriles

46. Electrochemistry is the study of the interchange of

- a) Chemical energy and photon
b) Chemical energy and electrical energy
c) Electrical energy and photon
d) None of the above

47. Radioactivity involves emission of.....

- a) Alpha, Beta, Gamma particles etc.
b) heat
c) Radiowaves
d) photons.

48. In which cell electrical energy is converted into chemical energy?

- a) Galvanic cell (b) Daniel cell
c) Voltaic cell (d) Electrolytic cell.

49. In electrolytic cell electrons moves from
- Ion to ion
 - ion to cathode
 - Anode to cathode through external circuit
 - Cathode to anode through external circuit
50. Duaghter nuclei in nucler decay reaction are..... than the parent nuclei.
- Lower in mass and energy
 - Equal in mass and charge
 - Lower in energy and charge
 - Higher than mass and charge
51. Steel is the of iron with carbon content intermediate between cast iron and wrought iron.
- Alloy
 - Either mixer or alloy
 - Mixer
 - None of these
52.are physiologically active, basic, nitrogen containing heterocyclic of plant origin that are mostly optically active.
- Terpenoids
 - Alkaloids
 - Isoprenoids
 - polyterpenoids

53. Citral's cis isomer is called and trans isomer is called

- a) neral, geranial
- b) geranial, neral
- c) terpenoid, isoprene
- d) isoprene, terpenoids

54. Citral's..... isomer is called neral and isomer is called geranial

- a) cis, trans
- b) trans, cis
- c) cis, cis
- d) trans, trans

55. The general molecular formula of an isoprene unit is?

- a) C_5H_{10}
- b) C_5H_8
- c) C_4H_{10}
- d) C_4H_8

56. Catalyst is used in the manufacturing of ammonia

- a) Fe
- b) Mg
- c) Ni
- d) Co & Cu

57. Coke is nothing but.....

- a) $CaCO_3$
- b) C
- c) FeO_3
- d) CO_2

58. Paludrin (Proguanil) is a drug.

- a) Antifungal
- b) Antimalarial
- c) Antineoplastics
- d) Antibacterial

59. Phenobarbital is adrug.
- a) Antimalarial
 - b) Central Nervous System (CNS)
 - c) Antitubercular
 - d) Antidiabetics
60. The drugs which are used to lower down the body temperature in condition of fever but not below of normal body temperature are
- a) Anaesthetics
 - b) Antidiabetics
 - c) Antipyretics
 - d) Antihistamine agent
61. Which of the following components of biological membrane are amphipathic?
- a) Integral membrane proteins
 - b) Phospholipids
 - c) Glycolipids
 - d) Membrane steroids such as cholesterol
62. Which of the following statements is correct?
- a) Animal and fungal cells contain chloroplasts.
 - b) Animal and plant cells do not contain mitochondria.
 - c) Plant, animal and bacterial cells possess cell wall.
 - d) Animal cell is devoid of cell wall.

63. The site present in the enzyme where reaction occurs is termed as

- a) Substrate site
- b) Active site
- c) Product site
- d) Reactant site

64. DNA is wound around the protein

- a) Histone
- b) Chromatosome
- c) Chromatin
- d) Nucleosome

65. Which of the following is not an example of biological nanomotor

- a) Kinesin
- b) Dynein
- c) Flagella
- d) Exosomes

66.composed of proteins is a part of the cell envelope found in almost all archaea and in many types of bacteria.

- a. Lipoprotein
- b. Flagella
- c. Cilia
- d S-layer (surface layer)

67.are small semiconductor crystals that can be used for the labeling of multiple disease markers

- a) Gold nanoparticles
- b) Magnetic nanoparticles
- c) Quantum dots
- d) Carbon nanotubes.

68. Which of the following is not a/an example of biological self- assembly

- a) Nucleic acid
- b) Phospholipid
- c) S-layer
- d) Amino acids

69. Anthrax is caused by Gram-Positive rod
- a) Bacillus subtilis b) Bacillus anthracis
- c) lactobacillus d) Bacillus cereus
70. A technique used in molecular biology for amplification of single or few DNA fragment is termed as
- a) Electrophoresis b) Polymerase chain reaction
- c) Microarray d) Sequencing
71. Rapid miniaturization of IC is explained inlaw
- a) Feynman's Law b) Moore's Law
- c) Einstein's Law d) Faraday's Law
72. For 2D nanomaterial the number of dimensions at the nanoscale are.....
- a) 1 b) 2
- c) 3 d) 0
73. Carbon nanotubes is an example of.....nanomaterial.
- a) OD b) 1D
- c) 2D d) 3D
74. The color of butterfly wings are observed because of..... effect.
- a) Absorption b) Transmission
- c) Interference d) luminescence

75. The sword of Tipu Sultan was made of.....

- a) Nano gold
- b) Nano aluminium
- c) Damascus steel
- d) Nano silver

76. Quantum dot is an example of.....nanomaterial.

- a) 0D
- b) 1D
- c) 2D
- d) 3D

77. 1 m = nm.

- a) 10^{-9}
- b) 10^{-8}
- c) 10^9
- d) 10^8

78. In 1 nm if 3 carbon atom sits, then in a cube of volume 10 nm^3 the number of carbon atoms will be

- a) 2700
- b) 27000
- c) 270000
- d) 27000000

79. The depletion layer of tunnel diode is very thin (10 nm) because p-n junction is.....

- a) pure
- b) lightly doped
- c) heavily doped
- d) separated with an insulating layer

80. Single electron transistor (SET) works only when

- a) $(e/2C) > kT$
- b) $(e/2C) kT$
- c) $(e/2C) < kT$
- d) $(e/2C) - kT$

81. Quantum dots are usually regarded as semiconductor nanocrystals with diameters in the range of.....

- a) 0.1-0.5 mm
- b) 8-10 nm
- c) 90-100 nm
- d) 900-1000 nm

82. In transmitted light Lycurgus cup looks like...

- a) Blue
- b) Green
- c) Yellow
- d) Red

83. The melting temperature of gold nanoparticle is.....

- a) 1190 °C
- b) 810°C
- c) 940 °C
- d) 1080 °C

84. In reflected light Lycurgus cup looks like...

- a) Blue
- b) Green
- c) Yellow
- d) Red

85. In Esaki diode, with increase in temperature, tunneling current.....
- a) Increases
 - b) Decreases
 - c) Remains same
 - d) become infinite
86. Extinction observed for metal nanoparticles is a combination of
- a) Absorption and reflection
 - b) Reflection and scattering
 - c) Absorption and scattering
 - d) Transmission and absorption
87. Magnetic nanoparticles are..... in nature.
- a) superparamagnetic
 - b) paramagnetic
 - c) ferromagnetic
 - d) anti-ferromagnetic
88. In a Tunnel diode, the tunneling involves
- a) Acceleration of electron in p side
 - b) Movement of electrons from the n-side of the conduction band to the p-side of the valance band
 - c) Charge distribution management in both the bands
 - d) Positive slope characteristic of the diode

89. Ballistic transport is observed when.....

- a) $MFP \ll \text{dimension of nanomaterial}$
- b) $MFP = \text{dimension of nanomaterial}$
- c) $MFP \gg \text{dimension of nanomaterial}$
- d) $MFP=0$

90. $Inm = \dots\dots\dots$

- a) $0.1 A^0$
- b) $1A^0$
- c) $10 A^0$
- d) $100 A^0$

91. Gels in which swelling agent is organic solvents is called?

- a. Organogels
- b. Aerogel
- c. Sol Gel
- d. Xero gel

92. What is Quanta of an electromagnetic energy and is the basic energy associated with light?

- a. Carbon
- b. Graphite
- c. Photon
- d. Gold

93. A bound state of electron and hole, pair is called?

- a) Electron
- b) Photon
- c) Magnetron
- d) Exciton

94. What is full form of GMR?

- a. Nano Sphere
- b. Nano Rods
- c. Nano circles
- d. Giant Magneto resistance

95. The reverse field strength at which magnetization is zero is called?

- a. Coercivity
- b. Magnetic saturation
- c. Reflection
- d. None of the above

96. The ballistic type of transport of electrons is seen in?

- a. SWCNT
- b MWCNT
- C. Magnets
- d. Quantum Dot

97. Who won the Nobel Prize for the discovery of electron tunnelling effect?

- a. Richard Feynman
- b. Leo Esaki
- c. Albert Einstein
- d Newton

98. What do you mean by CVD?

- a. Chemical vapour deposition.
- b. Chemical vapour density
- c. Chemical Varity deposition
- d. None of the above

99. Is allotrope of carbon with cylindrical nanostructure

- a) Graphene
- b) Carbon nanotube
- c) Carbon dot
- d) Fullerene

100. Following material is currently widely used as an adsorbent material in both for water purification and water plant treatment

- a) Zink nitrate
- b) Silver particles
- c) Activated carbon
- d) Iron mix



- Rough Work -

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