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**ENT - 57**

**Total No. of Pages : 24**

# M. Sc. Entrance Examination, 2024
# NANOSCIENCE AND TECHNOLOGY
# Sub. Code: 71144

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**Day and Date : Monday, 29-07-2024** **Total Marks : 100**

**Time : 10.30 a.m. to 12.00 noon**

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**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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1. For a reversible process,

   a) $dS = dQ/T$ b) $dS > dQ/T$

   c) $dS < dQ/T$ d) none of the mentioned.

2. Maxwell's equations consists of ..... equations.

   a) four b) three

   c) two d) one

3. The relationship am T = constant is known as

   a) Planck's law b) Kirchhoff's law

   c) Lambert's law d) Wein's law

4. The average distance travelled by a molecule between two successive collision is called as .....

   a) free path  b) mean free path

   c) mean free time  d) all the above

5. Fermi-Dirac statistics cannot be applied to .....

   a) Electrons.  b) Photons

   c) Fermions  d) Protons

6. Acoustic transducers convert ..... energy into another form and vice versa

   a) Sound  b) optical

   c) electrical  d) potential

7. The bending of light round the edges of an obstacle within the geometrical shadow is called .....

   a) Interference  b) Polarization

   c) Diffraction  d) Reflection

8. Nicol prism is made up of.....

   a) calcite crystal  b) quartz crystal

   c) sodium crystal  d) Iron crysta

9. The fringes obtained in wedge shaped thin film are of.....

a) increasing thickness

b) decreasing thickness

c) varying thickness

d) equal thickness

10. A hall free from reverberation is called as..... Hall.

a) Live b) dead

c) good d) none of these

11. A series LCR circuit has resonant frequency.....

a) $f_0 = \frac{1}{2\pi\sqrt{LC}}$

b) $f_0 = \frac{1}{\sqrt{LC}}$

c) $f_0 = \frac{1}{2\sqrt{LC}}$

d) $f_0 = \frac{1}{2\pi\sqrt{C}}$

12. A series LCR circuit at high frequency behaves like ..... circuit.

a) Capacitive b) Resistive

c) Inductive d) Capacitive and resistive

13. The current varying at the rate of 6A/s in one coil, induces an emf of 2V in neighbouring coil. Calculate the mutual inductance of pair of coils.

a) 0.78 H b) 0.66 H

c) 0.24 11 d) 0.33 H

14. Equation which gives mutual inductance of two coils is also known as .....

    a) Newton formula  b) Newmann formula

    c) Kepler's law  d) Law of inertia

15. Energy stored per unit volume in magnetic field is, .....

    a) $\frac{B^2}{9\mu_0}$

    b) $\frac{B^2}{2\mu_0}$

    c) $\frac{B^2}{\mu_0}$

    d) $\frac{2B^2}{\mu_0}$

16. Dimensions of Impulse are.....

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

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

17. Calculate the acceleration produced when a force of 400 N acts on a body of mass 2000 kg.

    a) 0.2 $m/s^2$  b) 0.4 $m/s^2$

    c) 0.6 $m/s^2$  d) 4 $m/s^2$

18. In linear motion inertia is equivalent of.....

    a) Torque  b) Mass

    c) Force  d) acceleration

19. One of the pseudo force that arise in the case of circular motion is the..

a) Centrifugal force b) Gravitational force

c) Electrostatic force d) Magnetic force

20. If the surface tension of a liquid drop is 'T' then the excess pressure inside the drop of radius 'r' is.....

a) (4T)/r b) (T)/r

c) (2T)/r d) (6T)/r

21. Atomic packing fraction (%) of the Body Centred Cubic crystal is.....

a) 74% b) 84%

c) 52% d) 68%

22. The correct expression for Bragg's law is $n\lambda =$ _____

a) $d\sin\theta$ b) $de\cos\theta$

c) $2d\sin\theta$ d) $2d\cos\theta$

23. In Hall Effect, the directions of electric field and magnetic field are .....

a) Parallel to each other

b) Perpendicular to each other

c) such that makes acute angle with each other

d) such that makes obtuse angle with each other

24. If 'V' is electric field and '*p*' is the charge density then the Laplace's equations is given by.....

a) $\nabla^2.V = 0$

b) $\nabla^2.V = -\rho/\varepsilon_0$

c) $\nabla^2.V = 2(\rho/\varepsilon_0)$

d) $\nabla^2.V = -3(\rho/\varepsilon_0)$

25. If constraint relations do not explicitly depend on time then it is.....

a) Scleronomic b) Rheonomic

c) Holonomic d) Non-Holonomic

26. Equation of motion for the Atwood Machine is.....

a) $a = \left(\frac{m_1+m_2}{m_1-m_2}\right)g$

b) $a = \left(\frac{m_1m_2}{m_1+m_2}\right)g$

c) $a = \left(\frac{m_1+m_2}{m_1m_2}\right)g$

d) $a = \left(\frac{m_1-m_2}{m_1+m_2}\right)g$

27. The magnetism of a magnet is due to

a) earth

b) cosmic rays

c) due to pressure of big magnet inside the earth

d) spin motion of electrons

28. Lenz' law states that the direction of the induced emf and hence current

    a) Is determined by the rate of current flux

    b) Is found by the right hand rule

    c) Is found by the left hand rule

    d) Always opposes the cause producing it

29. Referred to as the specific reluctance of a material

    a) Resistivity b) Reluctivity

    c) Conductivity d) Permeability

30. Which of the following statements is true about magnetic field intensity?

    a) Magnetic field intensity is the number of lines of force crossing per unit volume.

    b) Magnetic field intensity is the number of lines of force crossing per unit area.

    c) Magnetic field intensity is the magnetic induction force acting on a unit magnetic pole.

    d) Magnetic field intensity is the magnetic moment per unit volume.

31. The electrostatic force of attraction between oppositely charged ions is known as a ..... bond.

    a) Chemical b) Ionic

    c) Covalent d) Metallic

32. General formula of alkynes (C ≡ C) has.....

a) $C_nH_{2n}$ b) $C_nH_{2n+2}$

C) $C_nH_{2n-2}$ d) None of these

33. How many steps in Radical Chain Mechanism.

a) 1 b) 2

c) 3 d) 4

34. What are the possible values of the spin quantum number?

a) 1 b) 2

c) 3 d) 4

35. MOT was proposed by .....

a) Pauling-Slater b) Hund, Mulliken, Hukckel

c) Gillespie and Nyholm d) Sidiwick and Powell

36. Efficiency of Carnot cycle is given by.....

a) $\varepsilon=W/T$ b) $\varepsilon=T/W$

c) $\varepsilon=W/q_2$ d) all of these

37. Entropy of the universe tends towards.....

a) maximum b) minimum

c) zero d) none of these

38. The pH of $10^{-8}$ M HCl is.....

a) 8 b) 7

c) between 7 and 8 d) between 6 and 7

39. Which of the following is the strongest conjugate base?

a) $Cl^-$ b) $SO_4^{2-}$

c) $CH_3COO^-$ d) $NO_3^-$

40. The increasing order of nucleophilicity would be?

a) $CI^- Br^- < I^-$ b) $I^- < C1 < Br^-$

c) $Br^- < Cl^- < F^-$ d) $I^- < Br < Cl^-$

41. among the following is not the property of a solution?

a) A solution can be separated by filtration

b) It can only be done when solute is solid.

c) Solute particles will settle down when left undisturbed for a while

d) More than one of the above

42. When three of the phases of a two-component system are simultaneously in equilibrium the number of degrees of freedom is .....

a) 0 b) 1

c) 2 d) 3

43. I- E/R is mathematical expression for ..... law .....

a) Kohlrauschs b) Hittorfs

c) Ohm's d) Boyle's

44. Which of the following processes is required for extracting metal from cinnabar ore?

a) Roasting b) Electrolytic reduction

c) Thermit process d) Calcination

45. By successively reacting glycerol with HCl, dil. $HNO_3$, HCN, KCN followed by acid hydrolysis we get.....

a) cinnamic acid b) aconitic acid

c) acrylic acid d) citric acid

46. Grabrial synthesis makes use of .....

a) Alkyl halides b) phthalimide

c) Hydrazine d) All of these

47. Starch is a plant polysaccharide consisting of.....

a) Amylose and cellulose

b) Amylopectin and cellulose

c) Cellulose and lactose

d) Amylose and amylopectin

48. Effective atomic number of Fe in $K_3[Fe(CN)_6]$ is.....

a) 34 b) 35

c) 32 d) 37

49. Compound of .....ions are colourless.

a) $Cu^+$ b) $Ni^{2+}$

c) $Cu^{2+}$ d) $Fe^{2+}$

50. Boyle's law states that at constant temperature, the volume of a given mass of gas is .....

a) Directly proportional to its pressure

b) inversely proportional to its pressur.

c) Directly proportional to its Concentration

d) none of these..

51. What is nuclear chemistry?

a) Study of electronic reactions

b) Study of nuclear reactions

c) Study of Biochemical reactions

d) Study of light reactions

52. The spontaneous immersion of radiations by an element is

a) Radioactivity b) Chemical activity

c) Bioactivity d) None of the above

53. Radioactivity involves emission of.....

    a) Alpha, Beta, Gamma particles etc.

    b) heat

    c) Radiowaves

    d) photons

54. Radioactivity is due to consequences of..... reaction

    a) Chemical  b) Biological

    c) Nuclear  d) All of the above

55. Daughter nuclei in nuclear decay reaction are..... than the parent nuclei.

    a) Lower in mass and energy

    b) Equal in mass and charge

    c) Lower in energy and charge

    d) Higher than mass and charge

56. In artificial transmutation..... elements are bombarded with projectiles to produce daughter elements.

    a) Non-radioactive  b) Radioactive

    c) metal  d) active

57. What is conserved in nuclear reaction?

    a) Nucleons  b) Charge

    c) Mass energy relation  d) All of the above

58. What is nuclear fusion?

a) Splitting of nucleus

b) Combination of nuclei

c) Production of lighter daughter nuclei

d) Both a and c

59. Natural radioactivity is.....

a) Artificial transmutation

b) Spontaneous emission of radiation

c) Decay without any emission

d) All of the above

60. According to Bronsted Lowry theory base is...

a) Proton acceptor b) Proton donor

c) Electron donor d) Electron acceptor

61. Anthrax is caused by Gram-Positive rod

a) Bacillus subtilis b) Bacillus anthracis

c) Lactobacillus d) Bacillus cereus

62. ..... involved in transformation process is commonly used for production of transgenic plant

a) Escherichia coli b) Bacillus subtilis

c) Staphyllococcus aureus d) Agrobacterium tumefaciens

63. Plasmid vector in genetic engineering means

a) Virus that transfers genes to bacteria

b) Extra chromosomal self-replicating circular DNA

c) Any fragment of DNA carrying a desirable gene

d) Sticky end of DNA

64. The basic immunoglobulin (Ig) unit is composed of .....

a) 2 identical heavy and 2 identical light chains.

b) 2 identical heavy and 2 different light chains.

c) 2 different heavy and 2 identical light chains.

d) 2 different heavy and 2 different light chains.

65. ..... is used for visualization and separation of nucleic acids

a) Polyacryl amide gel electrophoresis

b) Agarose gel electrophoresis

c) Centrifugation

d) Dialysis

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

a) Nucleic acid

b) Phospholipid

c) S-layer

d) Amino acids

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

a) Gold nanoparticles b) Magnetic nanoparticles

c) Quantum dots d) Carbon nanotubes

68. Which of the following is not a natural biopolymer?

a) Polyethylglycol b) Chitin

c) Cellulose d) Collagen

69. .....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)

70. Which of the following is not an example of biological nanomtor

a) Kinesin b) Dynein

c) Flagella d) Exosomes

71. There is plenty of room at the bottom." This was stated by ..... .

a) Eric Drexler b) Richard Feynman

c) Harold Croto d) Richard Smalley

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

    a) Sol gel  b) Ball milling

    c) Sputtering  d) PLD

73. Which of the following is an example of top-down approach for the preparation of nanomaterials?

    a) Sol gel  b) Ball milling

    c) Electrodeposition  d) CVD

74. Fullerene or Bucky ball is generally made up of .....carbon atoms.

    a) 100  b) 75

    c) 20  d) 60

75. Carbon nanotubes are categorized as .....

    a) SWNT  b) MWNT

    c) Both a and b  d) None of these

76. A Mesoporous material is a material containing pores with diameters between .....

    a) 2 and 50 nm

    b) 1 to 10 nm

    c) 100 to 150 nm

    d) None of the above

77. Due to the ..... properties it holds, Mesoporous silica nanoparticles is an excellent material for use in medical field

a) Reactivity and sensitivity

b) Biocompatibility and low toxicity

c) Surface area and pores

d) Cheap and abundant

78. Toxic nanoparticles entry through food products to gastro intestine route is called .....

a) Dermal b) inhalation

c) ingestion d) injection

79. Titanium dioxide ($TiO_2$) is an important semiconducting material

a) p-type b) *n*-type

c) combined d) neutral

80. A surface process wherein pollutants are attached on a solid surface by physical forces or chemical bond called .....

a) Adsorption b) Absorption

c) Filtration d) All of the above

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

a) Organogels b) Aerogel

c) Sol Gel d) Xero gel

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

a) Carbon b) Graphite

c) Photon d) Gold

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

a) Electron b) Photon

c) Magnetron d) Exciton

84. What is full form of TMR?

a) Nano Sphere

b) Nano Rods

c) Nano circles

d) Tunnel Magneto resistance

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

a) Coercivity

b) Magnetic saturation

c) Reflection

d) None of the above.

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

a) SWCNT b) MWCNT

c) Magnets d) Quantum Dot

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

a) Richard Feynman b) Leo Esaki

c) Albert Einstein d) Newton

88. What do you mean by PVD?

a) Physical vapour deposition

b) Chemical vapour density

c) Chemical Varity deposition

d) None of the above

89. ..... Is allotrope of carbon with plate like nanostructure

a) Graphene b) Carbon nanotube

c) Carbon dot d) Fullerene

90. 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

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

a) 0.1-0.5 nm b) 8-10 nm

c) 90-100 nm d) 900-1000 nm

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

a) Blue b) Green

c) Yellow d) Red

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

a) 1190 °C b) 810 °C

c) 940 °C d) 1080 °C

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

a) Blue b) Green

c) Yellow d) Red

95. In Esaaki diode, with increase in temperature, tunneling current .....

a) Increases

b) Decreases

c) Remains same

d) become infinite

96. 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

97. Magnetic nanoparticles are..... in nature.

a) superparamagnetic b) paramagnetic

c) ferromagnetic d) anti-ferromagnetic

98. 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

99. Ballistic transport is observed when .....

a) MFP << dimension of nanomaterial

b) MFP dimension of nanomaterial

c) MFP >> dimension of nanomaterial

d) MFP =0

100. 2 nm = .....

a) 0.2 A° b) 2 A°

c) 20 A° d) 200 A°

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