Series A

Register number : ………………………………………… Date : …………………………

ENTRANCE EXAMINATION FOR M.Tech NANOSCIENCE AND TECHNOLOGY- 2019

NANOSCIENCE AND TECHNOLOGY

Instructions

- You are provided with a Question booklet and an Optical Marker Reader (OMR) Answer sheet to mark your responses. Write your Register number and Date of the examination in the space provided on the top of this booklet. Read carefully all the instructions given in the OMR sheet

- This question booklet contains 100 multiple choice questions. Each correct answer carries 1 Marks.

1. Electromagnetic radiation with maximum wavelength is
    (a) Ultraviolet   (b) radio waves   (c) X-rays   (d) infrared
2. The wave characteristics of electron was experimentally established by
    (a) De Broglie   (b) Davisson and Germer(c) Schrodinger   (d) Niels Bohr
3. If uncertainty in the position of an electron is zero, the uncertainty in its momentum will be
    (a) $< h/4\pi$ (b) $> h/4\pi$ (c) zero   (d) infinite
4. The principal quantum number represents
    (a) Shape of an orbital   (b) number of electrons in an orbit   (c) distance of an electron from the nucleus   (d) orientation of orbitals in space
5. Which of the following statement is **incorrect**
    (a) γ-rays are charge less electromagnetic radiations   (b) γ-rays travel with the same velocity as that of light   (c) α- rays are deflected more than β-rays in an electric field   (d) β-particles carry same charge and mass as that of electron
6. Elements in which 4f orbitals are progressively filled in are called as
    (a) Transition elements   (b) Lanthanides   (c) Actinides   (d) Inert gases
7. The leakage current across a pn junction is due to ……
    (a) Minority carriers   (b) majority carriers   (c) junction capacitance   (d) none of the above
8. At absolute temperature, an intrinsic semiconductor has …….
     (a) A few free electrons (b) many holes (c) many free electrons   (d) no holes or free electrons
9. A zener diode is used as…….
    (a) An amplifier   (b) a voltage regulator   (c) a rectifier   (d) a multivibrator
10. In TV transmission, picture signal is ……………………..modulated
    (a) Frequency (b) Phase   (C) amplitude   (d) none of the above
11. If a square wave is fed to a differentiating circuit, the output will be …….
    (a) Sine wave   (b) sharp narrow pulses   (c) rectangular wave   (d) triangular wave
12. Work function of metals is generally measured in ………
    (a) Joules   (b) electron – volt   (c) watt – hour   (d) watt
13. In a semiconductor, as the particle size decreases, the band-gap energy
    (a) Decreases   (b) Increases   (c) Does not change   (d) None of the above
14. 1 *nm*. is equal to
     (a) 10 Å   (b) 0.01 µm   (c) 100 Å   (d) None of the above
15. The particle size of a "quantum dot" can be estimated from
    (a) Nuclear Magnetic Resonance spectrum   (b) Electron Paramagnetic Resonance spectrum (c)UV-Visible absorption spectrum   (d) All the above
16. Nano colloids of gold was first prepared by;
    (a) J.J. Thomson   (b) Michael Faraday   (c) Alivisatos   (d)None of the above
17. A nanomaterial having a density of 6 gm./cc and having a specific surface area of 100 m^2/gm. has average particle size of;
     (a) 60 nm.   (b)10 nm.   (c)16.66 nm.   (d)100 nm.
18. The high tensile strength of nanomaterials are due to

(a) the high density of nanotubes (b)efficient interlocking of particles (c)each nanotube is one large molecule (d)Both B and C

19. Yttrium-Samarium-Cobalt grains have unusual magnetic properties due to
   (a) very high paramagnetism (b)large specific surface area
   (b) (c)high melting point (d)very strong intermetallic forces

20. Material in nanophase employed in the manufacture of ceramic capacitors is
   (a) $BaTiO_3$ (b)$ZnOZrO_2$ (c)ZnO (d)Cu-Fe Alloy

21. Amorphous solids _____.
   (a) possess sharp melting points (b) exhibit anisotropy (c) do not undergo clean cleavage when cutwith knife (d) possess orderly arrangement over long distances

22. Glass is a _____.
   (a) supercooled liquid (b) crystalline solid (c) non-crystalline solid(d) liquid crystal

23. In polar molecular solids, molecules are held together by _____.
   (a) dipole-dipole interactions(b) London dispersion forces (c) hydrogen bonds (d) covalent bonds

24. Which of the following is a hydrogen bonded molecular crystal?
   (a) HCl (b) H_2 (c) CH_4 (d) Ice

25. Crystals which are good conductor of electricity and heat are known as _____crystals.
   (a) Ionic (b) Covalent (c) Metallic (d) Molecular

26. Which of the following is an example of metallic crystal solid?
   (a) C (b) Si (c) W (d) AgCl

27. In fullerene, carbon atoms are _____hybridized.
   (a) Sp (b) sp^2 (c) sp^3 (d) Sp^3d

28. The three dimensional graph of lattice points which sets the pattern for the whole lattice is called---------------
   (a) space lattice (b) simple lattice (c) unit cell (d) crystal lattice

29. Which of the following is TRUE for diamond?
   (a) Diamond is a good conductor of electricity (b) Diamond is soft
   (c)Diamond is a bad conductor of heat (d)Diamond is made up of C, H and O.

30. In graphite, carbon atoms are joined together due to _____.
   (a) ionic bonding (b) van der Waal's forces
   (b) (c) metallic bonding (d) covalent bonding

31. Silicon is found in nature in the forms of _____.
   (a) body centered cubic structure (b)hexagonal close packed structure
   (c)network solid (d)face centered cubic structure

32. Mostly crystals show good cleavage because their atoms, ions or molecules are _____.
   (a) weakly bonded together (b)strongly bonded together
   (c) spherically symmetrical (d) arranged in planes

33. In photoelectric effect, the photocurrent
   (a) increases with increase in frequency of incident photon

(b) decreases with increase in frequency of incident photon

(c) doesnot depend on frequency of photon but depends only on the intensity of incident light

(d) depends on both intensity and frequency of incident photon

34. According to Bohr's postulates which activity can take up only discrete values?

(a) angular momentum   (b)momentum   (c) kinetic energy   (d)potential energy

35. Of the following radiations which have the highest energy

(a) λ=20 nm   (b)λ= 200 pm   (c)v= $2x10^8$ s^{-1} (dv= $2x10^{12}$ s^{-1}

36. Number of electrons present in metal ion M^{2+} is 28. Its atomic number is

(a) 28   (b)26   (c)30   (d)56

37. Uncertainity in the position of an electron, if the uncertainity in its velocity is 0.01 % in Bohr's 1st orbit of hydrogen is

(a) 265 nm   (b)2.65 nm   (c)26.5 nm   (d)265 Å

38. For particles having the same kinetic energy, the de Broglie wavelength is

(a) Directly proportional to its velocity   (b)Inversely proportional to its velocity

(c)Independent of velocity and mass   (d) Cannot be predicted

39. The radial wave function depends on

(a) Principal quantum number only   (b) Azimuthal quantum number only

(c)Both principal &azimuthal quantum number(d)Azimuthal &magnetic quantum number

40. What is the potential energy of an electron present in N-shell of the Be^{3+} ion?

(a) -3.4 eV   (b)- 6.8 eV   (c)- 13.6 eV   (d)- 27.2 eV

41. The maximum number of total nodes are present in

(a) 5s   (b) 5p   (c)5d   d)All have same number of nodes

42. The photoelectric emission from a surface starts only when the light incident upon the surface has certain minimum amount of energy

(a) intensity   (b)wavelength   (c)frequency   (d)velocity

43. How many electrons in an atom can have n=3 and l=2

(a) 1   (b)2   (c)5   (d)10

44. Which of the following features of an atom is not a direct result of Rutherford's experiment

(a) Extraordinary hollow nature of atom   (b)Existence of circular electronic orbit

(c)Small size of nucleus   (d)Exceptionally high density of nuclear material

45. How much of energy is required to remove an electron from the 6s orbital of H atom?

(a) 13.60 eV   (b)6.98 eV   (c)0.377 eV   (d)Can't be predicted

46. The momentum of photon is p. the energy associated with it is given by

(a) p/c   (b) pc   (c) c/p   (d) $\sqrt{p}/c$

47. A proton and an alpha particle are accelerated through the same potential difference. The ratio of the wavelength associated with the proton to that associated with the alpha particle is

(a) 4   (b) 2   (c) $\sqrt{8}$ (d) $1/\sqrt{8}$

48. If an electron is accelerated by applying 100V of potential difference in a discharge tube, the wavelength of a wave associated with the electron is nearly

(a) 1.23 pm   (b) 12.3 pm   (c) 123 pm   (d) 0.123 pm

49. If the energy of each photon is 10^{-18} J, the number of photons present in a light radiation of wavelength 1Å is

     (a) 100   (b) 200   (c) 1000   (d) 2000

50. How many electrons are there in 1 Coulomb of electricity

     (a) 6.023×10^{23} (b) 1.64×10^{-23} (c) 6.24×10^{18} (d) 3.24×10^{-24}

51. Both NMR and NQR spectra are observed in --------- region

     (a)   microwave   (b)radiofrequency   (c)X-ray   (d) UV-VIS

52. Raman Effect is

     (a)   elastic scattering of light   (b)ineleastic scattering of light   (c)emission of light   (d) absorption of light

53. The increase in rotational energy shows absorption in

     (a)   IR region   (b) UV region   (c) visible region   (d)Microwave region

54. The frequency of UV radiation is greater than

     (a) IR   (b) Microwave   (c)Both A and B   (d)None of these

55. State which of the following molecules can show pure rotational wave spectrum

     (a) N_2 (b) CO_2 (c) OCS   (d)HCl

56. The selection rule for the translational energy level in the Raman Spectrum is $\Delta J =$

     (a) ± 1 (b) ± 2 (c)$+1$ (d) $+2$

57. $\sigma \rightarrow \sigma^*$ transition λ lies in --------- region

     (a) IR   (b) visible   (c)UV   (d) none of these

58. Which is the cell organelle that is specialized in aerobic respiration?

     (a) Chloroplast   (b)endosome   (c)Golgi complex   (d)mitochondria.

59. Shoulder joint is an example for ---------- type of joint.

     (a) Ball and socket   (b)Hinge   (c)Pivot   (d)Saddle

60. Cardiac output is proportional to

     (a) Weight of the individual   (b)Height of the individual

     (b) Size of the heart   (d)None of the above

61. What are the basic constituents of the cell membrane?

     (a) Lipids   (b)proteins   (c)carbohydrates.   (d) All of them

62. What is the basic structure of a virus?

     (a) DNA or RNA   (b)Only DNA   (c)Only RNA   (d)None of them

63. In which habitat do birds live?

     (a) aerial environment by flying.   (b)aerial environment by sitting

     (c) aerial environment by swinging   (d) aerial environment by walking

64. The animal cells do not present?

     (a) chloroplasts   (b)presence of chloroplasts

     (b) presence of ribosome   (d)none of them

65. Electrons are

     (a) Bosons   (b)Maxwellons   (c)Fermions   (d) none of the above

66. Fermi energy is the level at which the probability of finding an electron is …….at 0K.
    (a) 0   (b)1   (c)1/2   (d)>1
67. Which one among the following is not a criterion for spontaneity?
    (a) $S<0$ (b)$G<0$ (c)$S>0$ (d)none of these
68. A simple cubic lattice consists of eight identical spheres of Radius R in contact, placed at the corners of the cube, what fraction of the total volume of cube is actually occupied by the cube?
    (a) 74%   (b)68%   (c)52.4%   (d)66%
69. Frenkel defect is
    (a) Missing of a n atom or ion from the normal lattice site
    (b) Location of atom at different position from normal lattice
    (c) Both of above(d) None of above
70. Choose from the following, the eigen function of the operator d/dx.
    (a) $\exp(kx)$ (b)$\sin^2 kx$ (c)$\sin kx$ (d)$\exp(-ikx^2)$
71. The eigen value of a Hermitian operator is
    (a) always imaginary   (b)always real

    (c) Imaginary in certain cases   (d) always a constant

72. The maximum uncertainty in position of a particle in a 1-D box of size a is
    (a) $a/2$ (b)$2a$ (c)a (d)0
73. Zero-point energy is a manifestation of
    (a) uncertainty principle   (b)correspondence principle
    (b) Frank-Condon principle   (d)antisymmetry principle
74. At absolute zero, the energy of a particle confined in a 1-D box is
    (a) unknown   (b)zero   (c)less than zero   (d)greater than zero
75. The probability of finding a particle confined in a 1-D box is the same in the left and right halves of the box
    (a) for states with even quantum numbers   (b) for all states
    (c) for none of the states   (d) for states with odd quantum numbers
76. The probability of finding a particle in its ground state in a 1-D-box of size a, between x = 0.2a and x = 0.4a, is

    (a) 0   (b)0.258   (c)1.0   (d)0.142
77. For a particle in a cube, degeneracy of the energy level E_{123} corresponding to the quantum numbers (1, 2, 3) is
    (a) 0   (b)1   (c)3   (d)6
78. The energy levels of a simple harmonic oscillator (vibrational quantum number = v) are
    (a) (v + 1/2)-fold degenerate   (b)doubly degenerate
    (c) nondegenerate   (d)unequally spaced
79. The selection rule governing the transitions of a simple harmonic oscillator (vibrational quantum number = v) is
    (a) $\Delta v = \pm 2$ (b)$\Delta v = \pm 1, \pm 2, \pm 3, \dots$ (c)$\Delta v = \pm 1$ (d)$\Delta v = \pm 1, \pm 3, \pm 5,$
80. The wave functions of a planar rigid rotator are
    (a) imaginary except for the ground state   (b)imaginary

    (c) real   (d) real except for the ground state

81. The Hall effect is used to measure
    (a) Type of semiconductor   (b)Determination of carrier concentration
(c)Determination of mobility   (d)all of these
82. The effective mass of electron in a semiconductor can be
    (a) negative near the bottom of the band
    (b) a scalar quantity with small magnitude
    (c) Zero at the center of the band
    (d) negative near the top of the band
83. Meisner effect implies that in super conducting state, a material has a magnetic susceptibility equal to
    (a) $\chi = 1$ (b)$\chi = -1$ (c)$\chi = -2$ (d)$\chi = 2$
84. Which of the following statement about superconductor is not true?
    (a) Type –I superconductors are completely diamagnetic
    (b) type II super conductor exhibit Miessner effect up to upper critical magnetic field
    (c) A type II superconductor exhibit zero resistance up to upper critical magnetic field
    (d) both Type I and Type-II superconductors exhibit sharp fall in resistance at super conducting transition temperature
85. Polyethylene is an
    (a) Elastomer   (b)Fibre   (c)Thermoplastics   (d)Thermosetting polymer
86. The monomers of Dacron
    (a) Ethylene glycol and terephthalic acid
    (b) Ethylene glycol and phthalic acid
    (c) Phenol and formaldehyde
    (d) Hexamethylenediamine and adipic acid
87. Bubble gum contains
    (a) Neoprene   (b)Isoprene   (c)Buna-S   (d)Buna-N
88. Synthetic rubber is
    (a) Isoprene   (b)Chloroprene   (c)Neoprene   (d)Orlon
89. In cationic polymerization, the initiator is a/an
    (a) Nucleophile   (b)Free radical   (c)Electrophile   (d)Carbenes
90. Buna S is a
    (a) Homopolymer   (b)Copolymer   (c)Natural polymer (d)Condensation polymer
91. Condensation polymers of dibasic acids or their anhydrides with polyhydric alcohols is
    (a) Glyptal   (b)Nylon   (c)Bakelite   (d)PMMA
92. The high tensile strength of fibres are due to
    (a) The presence of H bonds   (b)The presence of cross links
    (c)The presence of oxide linkage   (d)The presence of peroxide linkage
93. An example of semi synthetic polymer is
    (a) Leather   (b)Cellulose diacetate   (c)Nylon   (d)Teflon
94. Vulcanization of rubber was invented by
    (a) George Dunlop   (b) Charles Goodyear
    (c) Ziegler Natta   (d) Ferdinand Vulcan

95. With forward bias to PN junction, the width of the depletion layer
    (a) Decreases   (b) increases   (c) remains the same   (d) none of the above
96. At absolute temperature, an intrinsic semiconductor has----------

(a) A few electrons (b) many holes (c) many free electrons (d) no holes or free electrons

97. As the doping to a pure semiconductor increases, a bulk resistance of the semiconductor…………
    (a) Remains the same   (b) increases   (c) decreases   (d) none of the above

98. In an npn transistor, -------- are the minority carriers
    (a) Free electrons   (b) holes   (c) donor ions (d) acceptor ions

99. The output impedance of a transistor is----------
    (a) High   (b) zero   (c) low   (d) very low

100.   A photodiode is normally
    (a) Forward biased   (b) reverse biased   (c)neither forward or reverse biased
        (d) emitting light