Seat No.	

ENT - 35

Total No. of Pages : 14

Shivaji University, Kolhapur
M.Sc. Entrance Examination 2023
Sub. Code: 58717 (Set-III)
Subject: Physics

Day and Date : Tuesday, 08-08-2023 **Total Marks : 100**

Time : 10.30 a.m. to 12.00 noon

Instructions: 1. All questions are compulsory.
2. Each question carries 1 mark.
3. Maximum marks 100.

Select correct alternative for the following.

1. In .....frame of reference, Newton's law of motion are valid.

(A) inertial (B) non-inertial

(C) accelerated (D) all of above

2. For given inclined plane, acceleration of spherical shell is ..... that of solid cylinder.

(A) greater than (B) equal to

(C) less than (D) independent of

3. Kepler's second law of planetary motion is referred to as .....

(A) law of elliptical orbits (B) law of equal areas

(C) harmonic law (D) law of equal periods

4. Damped oscillatory motion occurs when the restoring force is.....

(A) greater than damping force (B) less than damping force

(C) equal to damping force (D) equal to external periodic force

5. A liquid wets a solid surface if the angle of contact between them is .....

(A) a right angle (B) an acute angle

(C) an obtuse angle (D) none of these

6. A potential due to point charge at a distance r from it is proportional to.....

(A) r (B) 1/r

(C) r^2 (D) $1/r^2$

7. A force which can be expressed as the gradient of a scalar potential is called.....

(A) conservstive (B) non-conservation

(C) pseudo (D) lamellar

8. The susceptibility of a dielectric medium of constant k is.....

(A) equal to k (B) less than k

(C) greater than k (D) zero

9. At resonance the LCR circuit is purely.....

(A) resistive (B) an inductive

(C) capacitive (D) capacitive and inductive

10. The coil in ballistic galvanometer wound on .....

(A) conducting (B) nonconducting

(C) magnetic (D) dielectric

11. All natural processes are.....

(A) isothermal (B) adiabatic

(C) irreversible (D) reversible

12. The entropy of universe is tending to .....

(A) minimum (B) Zero

(C) maximum (D) Constant

13. Phase velocity of a wave is v = ...

(A) w/k (B) k/w

(C) dw/dk (D) dk/dw

14. Period of energy transfer in coupled oscillations is .....

(A) T-2π/(001-002) (B) T= π/(01-02)

(C) T=3π/(01-02) (D) T=4π/(1-0)

15. The energy density of diffuse radiation inside the close encloser represent.....

(A) an average density

(B) area of a cell

(C) product of an average density and area of cell

(D) total area of phase space

16. Rayleigh-Jean's law is correct only for ..... region.

(A) short wavelength

(B) long wavelength

(C) long frequency

(D) maximum wavelength

17. Magnifying power is .....of wavelength of light used from the source or sources.

(A) independent

(B) larger for shorter wavelengths

(C) smaller for longer wavelengths

(D) dependent

18. What is the SI unit of resolving power?

(A) m^{-1} (B) cm^{-1}

(C) s^{-1} (D) unit less quantity

19. Beats are produced due to superposition of two.....

(A) harmonic oscillator

(B) collinear oscillations

(C) oscillations with slightly different frequencies

(D) all the above

20. In isothermal-isobaric process, which of the following function remains constant?

(A) internal energy (B) Helmholtz free energy

(C) Gibb's function (D) enthalpy

21. Two complex numbers $z_1 = x_1 + iy_1$ and $z_2 = x2 + iy_2$ are said to be equal if and only if -

(A) $x_1 = x_2$ (B) $y_1 = y_2$

(C) $x_1 = x_2$ & $y_1 = y_2$ (D) $x_1 = y_2$ & $y_1 = x_2$

22. Arg (z_1z_2) = ...

(A) $\arg\theta_1 - \arg\theta_2$ (B) $\arg\theta_1 + \arg\theta_2$

C) $\arg z_1 + \arg z_2$ (D) $\arg z_1 - \arg z_2$

23. Which one of the following is the polar form of complex number .....

(A) Z = x+iy (B) $Z = re^{1}\theta$

(C) z = r (cos θ+/sinθ) (D) z = (cosθ+/ sinθ)

24. For the equation day $x^2\frac{d^2y}{dx^2} + x\frac{dy}{dx} + y$ =0, the point of regular singularity is .....

(A) x = ∞ (B) x = 1

(C) x = 0 (D) x = -1

25. Order and degree of the differential equation, $\sqrt{\left(\frac{\partial^2 u}{\partial x^2}\right)^2 + \left(\frac{\partial u}{\partial y}\right)^3} - xyz$ =0 are .....

(A) 2,1 (C) 2,2

(B) 1,3 (D) 3,1

26. Relation between Beta and Gamma function is .....

A) $\beta(m,n) = \frac{\lceil m \lceil n}{\lceil m+n}$ **B)** $\beta(m,n) = \frac{\lceil m+n}{\lceil m \lceil n}$

C) $\beta(m,n) = \frac{\lceil m-n}{\lceil m \lceil n}$ **D)** $\beta(m,n) = \frac{\lceil m \lceil n}{\lceil m-n}$

27. If either P'(z) or Q'(z) or both analytical functions of differential equations

diverges but ZP(z) or zQ'(z) or both becomes finite, then the point X = 8. i.e z = 0 is a.....

(A) ordinary point (B) regular singularity point

(C) irregular singularity point (D) essential singular point -point.

28. The Bessel's equation has regular singularity at ..... point

(A) x = 1 (B) x = n

(C) x = ∞ (D) x = 0

29. $\frac{\partial^2 u}{\partial x^2}+\frac{\partial^2 u}{\partial y^2}$ **is a .....**

(A) three dimensional Laplace equation

(B) two dimensional Laplace equation

(C) two dimensional Bessel's equation

(D) three dimensional Bessel's equation

30. The value of β **(1, 2) is .....,**

(A) 1 (B) 2

(C) 1/2 (D) 1/4

31. Quantum mechanics reduces to classical mechanics in the limit h$\rightarrow$.....

(A) infinity (B) zero

(C) one (D) none of these

32. If d^3/dx^3 is an operator, operating on Eigen function e^{ax}, then Eigen value of an operator .....

(A) 2α (B) α^2

(C) 4α (D) α^3

33. Wave function is physically acceptable only when it is.....

(A) finite (B) single valued

(C) continuous (except V= ∞ (D) all of these

34. The wavelength of matter wave is independent of.....

(A) momentum (B) mass

(C) velocity (D) charge

35. The first experimental evidence of matter wave was given by.....

(A) de Broglie (B) Compton

(C) Davisson & Germer (D) Bohr

36. Which of the following are non-degenerate energy levels characterized by (n_x n_y n_z) for a particle in the rigid box.

(A) 121 (B) 113

(C) 221 (D) 222

37. If energy of the particle is less than the step potential then classically.....

(A) R=0, T-1 (B) R-1, T-0

(C) R-T-1/2 (D) R-2/3, T-1/3

38. The parity of wave function is odd when.....

(A) $\psi(-x)=-\psi(x)$ (B) $\psi(x) = -\psi(x)$

(C) $\psi(-x) = \psi(x^2)$ (D) $\psi(-x) = \psi(x)$

39. $[L^2, L_x]$ = ...

(A) $i\,h\,l_x$ (B) $-i\,h\,L_z$

(C) 0 (D) 1

40. ..... phenomenon can be explained using tunneling effect.

(A) **'y'** decay (B) Compton scattering

(C) 'α' decay (D) 'β' decay

41. Which of the following can be used as a set of generalized coordinates.

(A) Cartesian coordinate system

(B) Spherical coordinate system

(C) Cylindrical coordinates system

(D) All of the above

42. Generalized force .....

(A) always has the dimensions of force

(B) always has the dimensions of work

(C) May never have the dimensions of force or work

(D) None of the above is true.

43. The principle virtual work deals only the cases of-

(A) statics (B) dynamics

(C) mechanics (D) kinematics

44. Constraints that can be expressed as equations of coordinates and time, i. e., by an expression of the form f (r_1, $r_{2,}$ r_3....., r_n, t) = 0 are said to be:

(A) holonomic (B) nonholonomic

(C) scleronomous (D) Hieronymus

45. If all forces of a system are generated from a single function, the system is called system.

(A) conservative (B) monogenic

(C) non-conservative (D) polygenic

46. The purpose of Michelson-Morley experiment was .....

(A) to measure the variable speed of light through ether

(B) to calculate the absolute velocity of the earth through the ether the direction of motion

(C) to verify the length contraction in

(D) to verify the time dilation

47. The lowest possible mass of a particle is its .....

(A) relativistic mass (B) inertial mass

(C) gravitational mass (D) rest mass

48. For the moving observer, the time interval appears to .....

(A) remains constant (B) be lengthened

(C) be shortened (D) be virtua

49. Particle of mass m and charge q enters a magnetic field B perpendicularly with a velocity V, the radius of the circular path described by it will be .....

(A) mv/Bq (B) mB/qv

(C) mq/Bv (D) Bq/mv

50. An electric charge in uniform motion produces .....

(A) both electric and magnetic fields

(B) no such field at all

(C) a magnetic field only

(D) an electric field only

51. $\overline{A+B}=\overline{A}\cdot\overline{B}$ **is the statement of .....**

(A) De-Morgan's second theorem (B) De-Morgan's first theorem

(C) De-Morgan's third theorem (D) Boolean law

52. NOR gate is the combinations of-

(A) OR gate followed by NOT gate

(B) NOT gate followed by OR gate

(C) AND gate followed by OR gate

(D) AND gate followed by NOT gate

53. A transistor amplifier has a de collector current of SmA. What is the ac resistance of the base if β **200?**

(A) 100 Ω (B) 1000 Ω

(C) 1 Ω (D) 1Ω

54. In CE transistor amplifier circuit input is applied to .....terminal of the transistor.

(A) base (B) emitter

(C) collector (D) none of these

55. In phase shift oscillator, the expression for frequency is .....

(A) $f=\frac{1}{2\pi\sqrt{LC}}$ **(B)** $f=\frac{1}{2\pi\sqrt{RC}}$

(C) $f=\frac{1}{2\pi RC\sqrt{6}}$ **(D)** $f=\frac{1}{2\pi LC}$

56. To obtain Lissajous figures on the screen of the CRO, ac signal must be applied to

(A) X-plate only (B) Y- plate only

(C) both X and Y plates separately (D) Z- plate only

57. The vertical deflection plates in CRO are mounted in the .....

(A) horizontal plane (B) vertical plane

(C) inclined plane (D) both A & B

58. Differential amplifiers uses ..... stages of amplifiers.

(A) four balanced (B) two balanced

(C) three balanced (D) two unbalanced

59. In IC 555, output is observed at terminal number .....

(A) 3 (B) 5

(C) 4 (D) 2

60. For an ideal OP-AMP, open loop gain is .....

(A) 100 (B) 1

(C) 0 (D) infinite

61. The smaller the value of packing fraction, the nucleus is.....

(A) unstable (B) less stable

(C) moderately stable (D) more stable

62. Which one of the following corresponds to the 'Double magic numbers'?

(A) $_{2}He^{4}$ (B) $_{8}0^{16}$

(C) $_{20}Ca^{48}$ (D) all of these.

63. ..... accelerator provides maximum energy particles.

(A) Cyclotron (B) Synchrocyclotron

(C) Betatron (D) Proton synchrotron

64. In resonance orbital accelerators the frequency of revolution of particles is ..... frequency of accelerating potential.

(A) equal to the (B) greater than

(C) smaller than (D) not related to the

65. Scintillation counter detects.....

(A) α-particles only (B) β-particles only

(C) α and β particles only (D) α, β and Y particles

66. The working principle of cloud chamber states that the super saturated vapour remains ..... against the formation of droplets.

(A) stable (B) unstable

(C) first stable and then unstable (D) none of these.

67. ..... are elementary particles which are not constituted of quarks.

(A) Leptons (B) Baryons

(C) Mesons (D) Nucleons

68. ..... elementary particles have spin half and positive parity.

(A) Baryon (B) Pions

(C) Kaons (D) Photons

69. One atomic mass unit (amu) is equal to .....

(A) 931 g (B) 931 kg

(C) 931 MeV (D) 931 eV

70. Which one of the following equation is known as betatron condition?

(A) $\Phi = 2\pi r^2 B$ (B) $B = 2\pi r^2 \Phi$

(C) $\Phi = 2\pi r B$ (D) (D) $B = 2\pi r \Phi$

71. Wind farm is .....

(A) farm where wind flows heavily

(B) used for agricultural work

(C) grinding mills operate on wind power

(D) number of wind turbine generator units are installed in large area

72. To adjust the plane of blades normal to incoming wind -------- is used

(A) yaw control (B) pitch control

(C) speed control (D) gear control system

73. Solar constant is measured

(A) on earth surface

(B) at sea level

(C) outside the earth's atmosphere

(D) in earth's atmosphere

74. A solar PV panel has 50 cells and 100 modules. If power of each solar cell is 0.2 watt then power of the panel is .....

(A) 100 Watt (B) 1K Watt

(C) 25000 Watt (D) 10 watt

75. The critical temperature of a superconductor varies with its isotropic mass M as .....

(A)$Tc = M^{-1/2}$ (B)$Tc = M^{1/2}$

(C) $Te = M^{-1/4}$ (D)$Tc = M^{1/4}$

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

(A) Ball milling (B) Nucleation and growth

(C) Photolithography (D) Etching

77. Quantum dots are.....dimensional nanostructures.

(A) one (B) zero

(C) two (D) three

78. Which of the following method is physical method of synthesizing nanomaterials?

(A) Colloidal (B) Sputtering

(C) Spray pyrolysis (D) Electrodeposition

79. Decrease in size of quantum dot results in .....

(A) decrease in band gap energy

(B) increase in band gap energy

(C) either increase or decrease

(D) constant band gap energy

80. From physics point of view, energy is nothing but .....

(A) capacity to do work (B) energy to work

(C) power to do work (D)force to do the work

81. Frank-Condon principle helps in estimating the.....

(A) moment of inertia of the molecule (B) bond length

(C) reduced mass of molecule (D) intensity of bands

82. Anomalous Zeeman pattern is converted to normal Zeeman pattern when Lande's 'g' factor is .....

(A) 1 (B) 1.1

(C) 1.5 (D) 1.7

83. When a pair of electrons are shared by two atoms in a molecule, then..... is formed.

(A) a covalent bond (B) an ionic bond

(C) a metallic bond (D) no bond

84. White dwarfs are stars having .....

(A) low luminosity and high surface temperature

(B) high luminosity and low surface temperature

(C) low luminosity and low surface temperature

(D) high luminosity and high surface temperature

85. Selection rule for pure rotational transition is A ΔJ.....

(A) $\Delta J = 0$ (B) $\Delta J = +1$

(C) $\Delta J = 0, +1$ (D) $\Delta J = 0,1,2,3,...$

86. Diameter of Mars is ..... Km.

(A) 5832 (B) 7832

(C) 6832 (D) 3832

87. The massive stars on the main sequence evolve into .....star

(A) Neutron (B) super giant

(C) red giant (D) white dwarf

88. The steady-state theory of universe was proposed by ..... in 1948

(A) Herman Bondi and Thomas Gold (B) Hubble

(C) A.A. Friedman (D) Doppler and Bondi

89. The graph between luminosity and effective temperature of star is known as diagram

(A) Lande (B) phase

(C) H-R (D) Planck

90. Vibrational-rotational spectra are found in .....

(A) absorption (B) emission

(C) emission and absorption (D) evaporation

91. For simple cubic crystal structure, the relation between droo and dooz is given as

(A) $d_{100} = 2d_{002}$ (B) $d_{100} = d_{002}$

(C) $d_{100} = 0.5d_{002}$ (D) $d_{100} = 4\ d_{002}$

92. It the place cuts crystallographic axis at 2a, 3b and 4c, then then Miller indices of the plane is.....

(A) (234) (B) (346)

(C) (363) (D) (643)

93. Each crystal structure have ..... centre of symmetry

(A) one (B) two

(C) Three (D) Four

94. In reciprocal lattice (a*)* =

(A) 0 (B) 1

(C) a (D) 1/a

95. Bragg's condition for X-ray diffraction is .....

(A) $d\sin\theta = n\lambda$ (B) $2d\sin\theta = n\lambda$

(C) $2d\cos nx = n\lambda$ (D) $2\lambda\sin\theta = nd$

96. The susceptibility of diamagnetic material is .....

(A) positive and small (B) positive and large

(C) negative and small (D) negative and large

97. Saturation magnetization in paramagnetism is Ms = ...

A. $N\mu$ B. N/μ

C. $N\mu L(x)$ D. $N^2\mu$

98. According to Kronig-Penny model width of allowed energy band with increase in energy.

(A) decreases (B) increases

(C) Remains constant (D) doubles

99. The band gap energy of silicon is ..... eV

(A) 1.12 (B) 0.72

(C) 3.2 (D) 0.5

100. The effective number of free electrons that is $N_{eff} = 0$ for .....

(A) metals (B) metals and semiconductors

(C) semiconductors (D) an insulators