ENT – 03

Total No. of Pages : 20

Seat No.	

P.G. Entrance Examination, July - 2023

M.Sc. PHYSICS

Sub. Code : 58718

Day and Date : Tuesday, 18 - 07 - 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) **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) If an object is moving with a constant velocity, what is its acceleration?

(A) Zero (B) Constant

(C) Variable (D) Unknown

2) In rockets and Jet planes, the principle of conservation of _____ is used.

(A) angular momentum (B) energy

(C) linear momentum (D) mass

3) According to Kepler's law, the planetary orbits around the sun are _____

(A) circular (B) elliptical

(C) hyperbolic (D) parabolic

4) If natural frequency of vibration of a body is u and is subjected to periodic force of frequency v, then the body vibrates with frequency _____

(A) u (B) v

(C) greater than u (D) less than u

5) Two plates of glass wetted by few drops of water between them can be separated from each other by _____

(A) pulling them apart normal to the surface

(B) sliding them parallel to their planes

(C) introducing some more water between them

(D) introducing some oil between them

6) Coulomb's law is only true for point charges whose sizes are _____

(A) medium (B) very large

(C) very small (D) large

7) Ability of capacitor to store charge depends upon _____

(A) area of plates (B) distance between plates

(C) type of dielectric used (D) all of above

8) The formation of dipole is due to two equal and dissimilar point charges placed _____

(A) at a short distance (B) at a long distance

(C) above each other (D) at very long distance

9) Transistors and operational amplifiers are _____

(A) passive elements (B) active elements

(C) both active and passive elements (D) circuit elements

10) The magnetic field B is the curl of _____

(A) magnetic vector potential (B) current density

(C) electric scalar potential (D) current

11) Thermal equilibrium defines the constancy of _____

(A) volume (B) pressure

(C) temperature (D) entropy

12) Heat conduction through a body is an example of_____ process.

(A) reversible (B) irreversible

(C) isothermal (D) isochoric

13) In standing waves the points where amplitude is maximum is called _____

(A) displacement (B) wavelength

(C) antinodes (D) nodes

14) Potential energy due to stretching of a spring in a coupled oscillation is _____

(A) $\frac{k\left(X_2 - X_1\right)}{2}$ (B) $\frac{k\left(X_2 + X_1\right)}{2}$

(C) $\frac{k\left(X_2 - X_1\right)^2}{2}$ (D) $\frac{k\left(X_2^2 - X_1^2\right)}{2}$

15) Every phase point in phase space gives _____ at that point.

(A) momentum of molecule (B) probability

(C) state of motion of molecule (D) average energy

16) Using Maxwell's thermodynamics relations, the ratio E_S/E_T is _____

(A) 1 (B) 2

(C) γ (D) $1/\gamma$

17) By Rayleigh's modified criterion, the condition for resolution is that the ratio of the intensity at the saddle to the maximum intensity of either of the principal maxima of two close wavelength is _____

(A) $8/\pi^2$ (B) $\pi^2/8$

(C) $8\ \pi^2$ (D) $4/\pi^2$

18) There are three prisms A, B, C of base width 5 cm each with an angle of prism 30°, 36°, 45° respectively. If the light of wavelength 5000A° is incident on each of them, which has the highest resolving power?

(A) A

(B) B

(C) C

(D) All have the same resolving power

19) Pauli-exclusion principle does not apply in _____ statistics.

(A) Bose-Einstein (B) Fermi- Dirac

(C) Maxwell-Boltzmann (D) Both B.E and F. D

20) For two images to be just resolved when the central maximum of one should fall at _____ image.

(A) central maximum of the other

(B) first minimum of the other

(C) first secondary maximum of the other

(D) first secondary minimum of the other

21) Partial differential equation consist of _____

(A) only one dependent variable

(B) at least two independent variables

(C) two dependent variables

(D) at least one independent variable

22) The highest derivative term appearing in the differential equation is called _____ differential equation.

(A) degree of that

(B) order of that

(C) linearity of that

(D) both A & B

23) The equation $\left(\frac{\partial z}{\partial x}\right)^2 + \left(\frac{\partial z}{\partial y}\right)^2 = z^2$ is called _____ differential equation.

(A) Non-linear

(B) Laplace

(C) Bessele's

(D) Linear

24) The equation $\mathrm{P}(x)\frac{d^2y}{dx^2} + \mathrm{Q}(x)\,y = 0$ is a _____ differential equation.

(A) first order inhomogenous

(B) first order homogenous

(C) second order homogenous

(D) second order inhomogenous

25) For the equation $x(x-1)^3\frac{d^2y}{dx^2}+2(x-1)y+3y=0$, the point regular singularity is _____.

(A) $x = 0$ (B) $x = 1$

(C) both (A) & (B) (D) none of these

26) erf(0) + erf(∞) = _____.

(A) 1 (B) 2

(C) 0 (D) –l

27) $\int_0^{\pi/2}\sqrt{\tan\theta}\,d\theta =$ _____.

(A) $\frac{\pi}{2\sqrt{2}}$ (B) $\pi\sqrt{2}$

(C) $\frac{\pi}{\sqrt{2}}$ (D) $\frac{\pi}{\sqrt{3}}$

28) Addition of complex numbers holds _____

(A) commutative law (B) associative law

(C) distributive law (D) both (A) and (B)

29) The division of a complex number is _____

(A) pure real number (B) pure imaginary number

(C) again a complex number (D) natural number

30) If Z = $x + iy$ is a complex number, then z – z = _____.

(A) 2iI(z) (B) iI(z)

(C) 2R(z) (D) R(z)

31) Quantum mechanics reduces to classical mechanics in the limit $\hbar \rightarrow$ _____

(A) infinity (B) zero

(C) one (D) two

32) Expectation value of an observable in the stationary states is independent of _____

(A) space (B) time

(C) both space and time (D) length

33) In quantum mechanics, equation of continuity determines conservation of _____

(A) mass (B) charge

(C) probability (D) parity

34) The velocity with which individual wave associated with a particle moves is_____ velocity.

(A) phase (B) group

(C) particle (D) none of these

35) A narrow wave group have clearly defines _____

(A) energy (B) position

(C) wavelength (D) velocity

36) In a rigid box, potential energy of a free particle is _____

(A) zero (B) infinite

(C) one (D) none of these

37) Eigen value of an angular momentum operator (L_z) is _____

(A) $(m+1)\hbar$ (B) $l(l+1)\hbar$

(C) $(l+1)\hbar 2$ (D) $m\hbar$

38) In a hydrogen atom, potential (V) experienced by an electron at a distance 'r' from nucleus varies as _____

(A) $1/r^2$ (B) $1/r$

(C) $1/r^3$ (D) r

39) Ground state energy of a particle in a simple harmonic oscillator is _____

(A) $n\hbar\omega$ (B) $\hbar\omega/2$

(C) $nh\omega$ (D) $(n+1/2)\hbar\omega$

40) $[x, p_y]$ = _____.

(A) 0 (B) $\hbar$

(C) $i\hbar$ (D) $-i\hbar$

41) The hour's hand of a clock has _____ degrees of freedom.

(A) 1 (B) 2

(C) 3 (D) 5

42) For a particle moving under the action of a conservative force, the Lagrangian of the system is _____

(A) independent of the position

(B) increases in the direction of a conservative force

(C) decreases in the direction of conservative force

(D) more information is needed

43) A single particle is restricted to move on the surface of sphere, then the number of generalized coordinates are _____

(A) 2 (B) 3

(C) 6 (D) 4

44) If the Lagrangian does not depend on time explicitly is _____

(A) the Hamiltonian is constant

(B) the Hamiltonian cannot be constant

(C) the kinetic energy is constant

(D) the potential energy is constant

45) In variational principle the line integral of some function between two endpoints is _____

(A) zero (B) infinite

(C) extremum (D) one

46) In the case V << C, Lorentz transformation is the same as _____

(A) Einstein's transformation (B) Galilean transformation

(C) Maxwell's transformation (D) Plank's transformation

47) According to Einstein, the velocity of light in free space is _____

(A) depending on the direction of propagation

(B) variable

(C) constant

(D) infinite

48) How fast does a rocket have to move relative to an observer for its length to be contracted to 95% of its original length?

(A) 0.5 c (B) 0.4 c

(C) 0.3 c (D) 0.2 c

49) A charge 'q' is moving with a velocity V parallel to a magnetic field B. Force on the charge due to the magnetic field is

(A) zero (B) Bv/q

(C) qB/v (D) q v B

50) Lorentz force is _____

(A) the vector sum of the electrostatic and magnetic force acting on a moving charged particle

(B) the vector sum of the gravitational and magnetic force acting on a moving charged particle

(C) magnetic force acting on a moving charged particle

(D) electrostatic force acting on a charged particle

51) According to De-Morgan's first theorem NOR gate is equivalent to _____

(A) bubbled AND gate (B) bubbled OR gate

(C) AND gate (D) OR gate

52) _____ is a logic circuit that can add two bits at a time.

(A) RS flip flop (B) Half adder

(C) JK flip flop (D) Full adder

53) The voltage gain of an amplifier is expressed in _____

(A) ohm (B) volt

(C) amp. (C) decibel

54) In crystal 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) $f = \frac{1}{2\pi LC}$

55) Condition for Barkhausen criterion for sustained oscillations is _____

(A) $\beta \cdot A_V \geq 1$ (B) $\beta \cdot A_V \leq 1$

(C) $\beta \cdot A_V = 1$ (D) $\beta \cdot A_V \geq 2$

56) _____ prevents the walls of CRT from charging to a high negative potential.

(A) Aquadag (B) Focusing anode

(C) Electron gun (D) Accelerating anode

57) If operational amplifier has CMRR of 90 dB , if its differential voltage gain is 2,00,000. Calculate its common mode gain _____

(A) 6.33 (B) 6.9

(C) 0.95 (D) 9.5

58) Op-amp as an inverting amplifier can be used as a integrator by connecting a _____ in feedback path.

(A) resistance (B) capacitor

(C) inductance (D) diode

59) IC _____ is widely used as Timer.

(A) 555 (B) 741

(C) 7432 (D) 7408

60) Duty cycle in astable multivibrator varies between _____

(A) 0.5 to 1 (B) 0 to 0.5

(C) 1 to 1.5 (D) 0 to l.5

61) The magnetic moment of an electron is one Bohr magneton while that of proton is _____

(A) one Bohr magneton (B) one nuclear magneton

(C) two nuclear magneton (D) two Bohr magneton

62) The pairing effect in the semiempirical mass formula suggests that the _____ nuclei are most stable and abundant.

(A) even Z-even N (B) even Z-odd N

(C) odd Z-even N (D) odd Z-odd N

63) A frequency modulated supply is employed in _____

(A) cyclotron (B) synchrocyclotron

(C) betatron (D) electron-synchrotron

64) In betatron, the electron beam obtainable is pulsative at intervals of time _____ seconds.

(A) 1/50 (B) 1/200

(C) 1 (D) 50

65) Some energetic particles passing through transparent medium produce visible light, forms the principle of _____

(A) Cerenkov detector (B) Semiconductor detector

(C) Wilson cloud chamber (D) Scintillation detector

66) The time for which the GM counter becomes passive after discharge is called _____

(A) dead time (B) recovery time

(C) time of discharge (D) none of these

67) The total magnification produced by PMT is of the order of _____

(A) 10^3 (B) 10^6

(C) 10^9 (D) 10^{12}

68) Parity is not conserved in _____ interactions.

(A) gravitational (B) electromagnetic

(C) weak (D) strong

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

(A) 931g (B) 931kg

(C) 931 MeV (D) 931 eV

70) The quenching gas in GM tube is _____

(A) Air (B) Bromine vapour

(C) Argon (D) Water vapour

71) Maximum power from wind turbine for given incoming wind velocity v_i is _____.

(A) $P_{\max} = \frac{8}{27}\rho A v_i^3$ (B) $P_{\max} = \frac{27}{8}\rho A v_i^3$

(C) $P_{\max} = \rho A v_i^3$ (D) $P_{\max} = \frac{8}{27}\rho A v$

72) Which of the following is S.I. unit of wind power density?

(A) W/cm^2 (B) KW/cm^2

(C) W/m^2 (D) KW/m^2

73) In satellite station solar energy plant, the solar energy from satellite is send to the ground station in the form of _____

(A) IR waves (B) heat waves

(C) microwaves (D) light waves

74) There are *n* solar cells in a module and *m* modules in a panel. If P is the power of single solar cell, then power of the solar panel is _____

(A) $n \times m \times P$ (B) $n + m + P$

(C) $(n \times m)/P$ (D) $P/(n \times m)$

75) Anaerobe is a microorganism which grows in _____

(A) The presence of oxygen (B) Absence of oxygen

(C) Absence of moisture (D) Absence of H_2S

76) The essential properties of superconducting materials are _____

(A) only zero resistivity

(B) only perfect diamagnetism

(C) zero resistivity and perfect diamagnetism

(D) none of the above

77) Which of the following in 1D nanostructure?

(A) nanowire (B) nanorod

(C) nanoshell (D) nanotube

78) If the size of nanoparticles is decreased, its surface to volume ratio _____

(A) decreases (B) increases

(C) remains same (D) increases then decreases

79) The first talk about nanotechnology was given by _____

(A) Albert Einstein (B) Newton

(C) Gordon Moore (D) Richard Feynman

80) The magnetic lines of force cannot penetrate the body of a superconductor, this phenomenon is known as _____

(A) Isotope effect (B) London's effect

(C) Meissner effect (D) BCS theory

81) According to _____ theory, universe has beginning and end also.

(A) steady state (B) oscillating

(C) nebular (D) big bang

82) According to Big-Bang Hubble constant H _____ with time.

(A) increases (B) remains constant

(C) decreases (D) becomes zero

83) In NaCl molecule the bond formed is _____

(A) metallic (B) ionic

(C) covalent (D) spectral

84) Raman shift in frequency for antistokes line is _____

(A) positive (B) negative

(C) zero (D) very large

85) Transitions from S levels to the lowest P-level give rise to a spectral series called _____

(A) Diffuse (B) Sharp

(C) Principal (D) Fundamental

86) In Raman effect the lines on low frequency of exciting line are called _____ lines.

(A) Rayleigh (B) Stokes

(C) Antistokes (D) Stark

87) A molecular system can be stable if the total energy possessed by the molecular system is _____

(A) zero (B) minimum

(C) maximum (D) infinity

88) A star in the process of formation is called _____

(A) Protostar (B) *Red-giant*

(C) *White* dwarf (D) Cephied variable

89) _____ energy levels are always single.

(A) S (B) P

(C) D (D) F

90) The rotational energy of a molecule depends upon _____

(A) moment of inertia (B) charge

(C) centre of mass (D) axis of rotation

91) The c/a ratio in HCP crystal structure is _____

(A) 0.63 (B) 1.63

(C) 1.66 (D) 2.63

92) In HCP crystal structure system, If d_{100} = 2Å, then d_{002} = _____

(A) 1Å (B) l.63Å

(C) 2Å (D) 3.26Å

93) For, Simple cubic crystal structure, the relation between lattice parameter 'a' and atomic radius 'r' is _____

(A) r = a (B) r = a/2

(C) r = 2a (D) r = 4a

94) In reciprocal lattice _____

(A) a* .a = 0 (B) a*b = 1

(C) a*.a = l (D) a*.a = l/b

95) Volume of primitive cell of FCC lattice is _____

(A) a^3 (B) $(a^3)/2$

(C) $(a^3)/4$ (D) $(a^3)/6$

96) In powder method of X-ray diffraction _____

(A) λ is fixed while both θ and d varies

(B) λ is fixed and θ varies

(C) θ is fixed and λ varies

(D) λ and θ both are fixed

97) Curie law for paramagnetic material is _____

(A) $\chi = C/T$ (B) $\chi = C/(T - \theta)$

(C) $\chi = C/(T + \theta)$ (D) $\chi = CT$

98) The energy loss during hysteresis is the area of _____ loop.

(A) $\chi - T$ (B) B – H

(C) M – B (D) $\chi - H$

99) The effective mass of an electron is m* = _____

(A) d^2E/dk^2 (B) $[d^2E / dk^2] / \hbar^2$

(C) $(1/\hbar)[dE/dk]$ (D) $\hbar^2 / [d^2E/dk^2]$

100) The band gap energy of the semiconductor is of the order of _____ eV.

(A) 0 (B) 1

(C) 7 (D) Infinite

Rough Work

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