Total No. of Printed Pages : 21

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A

SET-Y

PG-EE-July, 2024

SUBJECT : Physics

10013

Sr. No. .....

Time : **1¼ Hours** Max. Marks : **100** Total Questions : **100**

Roll No. (in figures)_____ (in words) _____

Name _____ Date of Birth_____

Father's Name _____ Mother's Name_____

Date of Examination _____

_____ _____

(Signature of the Candidate) (Signature of the Invigilator)

CANDIDATES MUST READ THE FOLLOWING INFORMATION/INSTRUCTIONS BEFORE STARTING THE QUESTION PAPER.

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2. The candidates ***must return*** the question booklet as well as OMR Answer-Sheet to the Invigilator concerned before leaving the Examination Hall, failing which a case of use of unfair-means / mis-behaviour will be registered against him / her, in addition to lodging of an FIR with the police. Further the answer-sheet of such a candidate will not be evaluated.
3. Keeping in view the transparency of the examination system, carbonless OMR Sheet is provided to the candidate so that a copy of OMR Sheet may be kept by the candidate.
4. Question Booklet along with answer key of all the A, B, C & D code shall be got uploaded on the University Website immediately after the conduct of Entrance Examination. Candidates may raise valid objection/complaint if any, with regard to discrepancy in the question booklet/answer key within 24 hours of uploading the same on the University Website. The complaint be sent by the students to the Controller of Examinations by hand or through email. Thereafter, no complaint in any case, will be considered.
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1. The width of the plateau region in a GM counter depends upon :
   (1) Type of radiation
   (2) Energy of radiation
   (3) Both (1) and (2)
   (4) None of the above

2. Which of the following is a better material for shielding of Beta radiations ?
   (1) Aluminum
   (2) Lead
   (3) Platinum
   (4) Bismuth

3. The reaction time for a direct nuclear reaction is of the order of :
   (1) 10^{-10} second
   (2) 10^{-15} second
   (3) 10^{-20} second
   (4) 10^{-30} second

4. Which of the following is not true about Alpha emission ?
   (1) The atomic number of parent nucleus decreased by 2 after Alpha mission.
   (2) The mass number of parent nucleus decreased by 4 after Alpha mission.
   (3) The Alpha emission spectrum is a continuous spectrum.
   (4) The most energetic Alpha particles are emitted from Polonium-212.

5. The energy of a thermal neutron at 27°C is :
   (1) 0.026eV
   (2) 0.26eV
   (3) 2.6eV
   (4) 26eV

6. The density of the nucleus is of the order of :

(1) 10^{12}Kgm^{-3} (2) 10^{17}Kgm^{-3}

(3) 10^{22} Kgm^{-3} (4) 10^{27} Kgm^{-3}

7. Beta decay is a consequence of :

(1) strong nuclear force

(2) electromagnetic force

(3) weak nuclear force

(4) gravitational force

8. The number of electron-ion pairs created by a Gamma radiation of energy 1 MeV in a gas having ionization potential equal to 25 V is :

(1) 6.4×10^6 (2) 6.4×10^4

(3) 4×10^6 (4) 4×10^4

9. The minimum energy of photon required for pair production is :

(1) 1.022 eV

(2) 1.022 KeV

(3) 1.022 MeV

(4) 511 KeV

10. In terms of Redburg's constant (R), the wave number of first Balmer line is :

(1) R

(2) 3R/4

(3) 5R/36

(4) 8R/9

11. The ratio of the longest wavelength and the shortest wavelength observed in high spectral series of the emission spectrum of hydrogen is :

(1) 4/3 (2) 525/376

(3) 25/1 (4) 36/1

12. The selection rules for passing back effect are :

(1) $\Delta m_j = 0$

(2) $\Delta m_j = 0, \pm 1$

(3) $\Delta m_j = 0, \pm 1, \Delta m_s = 0$

(4) $\Delta m_j = 0, \pm 1, \Delta m_s = 0, \pm 1$

13. The possible values of magnetic quantum number for each l are given by :

(1) $2l - 1$, (2) $2l + 1$,

(3) $l - 2$, (4) $l + 1$

14. The splitting of a single line singlet into three component lines in the presence of magnetic field is :

(1) Paschen-Back effect

(2) Normal Zeeman effect

(3) Anomalous Zeeman Effect

(4) Joule-Kelvin effect

15. The possible values of Jz for $^2D_{3/2}$ state of an electron are :

(1) $\frac{3}{2}\hbar; \frac{1}{2}\hbar; \frac{-3}{2}\hbar; \frac{-5}{2}\hbar$

(2) $\frac{3}{2}\hbar; \frac{1}{2}\hbar; \frac{-1}{2}\hbar; \frac{-3}{2}\hbar$

(3) $\frac{5}{2}\hbar; \frac{3}{2}\hbar; \frac{-3}{2}\hbar; \frac{-5}{2}\hbar$

(4) $\frac{5}{2}\hbar; \frac{3}{2}\hbar; \frac{1}{2}\hbar; \frac{-1}{2}\hbar$

16. The full form of laser is :

(1) Light Amplification of Stimulated Emission Radiation

(2) Light Amplification of Spontaneous Emission Radiation

(3) Light Amplification by Spontaneous Emission of Radiation

(4) Light Amplification by Stimulated Emission of Radiation

17. The coherence length of a laser beam with wavelength 440nm and coherence time 40μs is :

(1) 11 Km
(2) 12 Km
(3) 1.1 m
(4) 1.2 Km

18. If the distance between two plane mirrors forming the resonant cavity is 0.3 m, then the difference between frequencies of consecutive modes will be :

(1) 500MHz
(2) 100MHz
(3) 5MHz
(4) IMHz

19. The function of Helium atom in the Helium-Neon laser is :

(1) to provide energy to the Neon atoms
(2) to quench the Neon atoms
(3) to make Neon atoms inactive
(4) none of the above

20. In ruby laser, the rod is surrounded by a helical photographic flash lamp filled with :

(1) neon
(2) xenon
(3) aluminum
(4) chromium

21. The energy of the lowest state in one dimensional box of length a is :

(1) Zero
(2) $\frac{h}{4ma^2}$
(3) $\frac{h}{8ma^2}$
(4) $\frac{h^2}{8ma^2}$

22. The wavefunction of a particle is given by :

$\psi = Ae^{-kx}$ for $0 < x < \infty$
$= 0$ for $-\infty < x < 0$

The value of A is :

(1) $\sqrt{\frac{k}{2}}$ (2) $\sqrt{k}$

(3) $\sqrt{\frac{2}{k}}$ (4) $\sqrt{\frac{1}{k}}$

23. In one dimensional potential box of length a, the probability of finding a particle will be maximum at :

(1) Zero (2) $\frac{a}{4}$

(3) $\frac{a}{2}$ (4) a

24. According to Schrödinger, a particle is equivalent to :

(1) A sound wave
(2) A wave packet
(3) A light wave
(4) A single wave

25. An eigenfunction of an operator $\frac{d^2}{dx^2}$ is e^{ax}. The corresponding eigenvalue will be :

(1) 1 (2) $\alpha^{0.5}$

(3) α (4) α^2

26. If an electron, a proton, and a neutron have same de-Broglie wavelength, then which particle has greater velocity ?

(1) Election
(2) Proton
(3) Neutron
(4) All have same velocity

27. If an α-particle and a proton have same kinetic energy, then the ratio wavelengths of the α- particle and the proton will be

(1) 1 : 2 (2) 1 : 4

(3) 2 : 1 (4) 4 : 1

28. The linear momentum of a photon with weavelength λ will be :

(1) Zero (2) $\frac{h}{\lambda}$

(3) $\frac{h}{\lambda^2}$ (4) $\frac{h}{c\lambda}$

29. The threshold wavelength of sodium metal is 6800 Å. The work function of sodium metal is :

(1) 0.91 eV (2) 1.82eV

(3) 2.27eV (4) 3.64eV

30. If the uncertainty in the position of an electron is 1 Å, then the value of uncertainty in its momentum will be :

(1) $6.6 \times 10^{-34} Kgms^{-1}$ (2) $2.2 \times 10^{-34} Kgms^{-1}$

(3) $3.33 \times 10^{-24} Kgms^{-1}$ (4) $1.03 \times 10^{-24} Kgms^{-1}$

31. What should be the velocity of an electron so that its linear momentum becomes equal to that of a photon of wavelength 10 Å ?

(1) $3 \times 10^8 ms^{-1}$ (2) $3 \times 10^7 ms^{-1}$

(3) $7.27 \times 10^6 ms^{-1}$ (4) $7.27 \times 10^5 ms^{-1}$

32. An electron is accelerated from rest through a potential difference of 200 v. If e/m for electron is 1.6×10^{11} C/Kg, the speed acquired by the electron will be :

(1) $8 \times 10^6 ms^{-1}$ (2) $8 \times 10^5 ms^{-1}$

(3) $5.656 \times 10^6 ms^{-1}$ (4) $5.656 \times 10^5 ms^{-1}$

33. According to Debye theory, the specific heat of solids at low temperature is proportional to :

(1) T^0 (2) T

(3) T^2 (4) T^3

34. Which of the following is not correct with regard to Debye approximation ?

(1) Debye theory obeys Doulong and Petit's law at high temperatures.

(2) The quantum considerations carry great significance at high temperatures.

(3) At low temperatures the phonons obey same statistics as that obeyed by photons at all temperatures.

(4) The specific heat of solids is proportional to T^3 at low temperatures.

35. How many space Lattices can be obtained from the different crystal systems ?

(1) 8 (2) 14

(3) 32 (4) 230

36. How many unit cells are present in a cube - shaped ideal crystal of NaCI of mass 1g ? [Atomic mass of Na and CI are 23 and 35.5, respectively]

(1) 1.03×10^{22} (2) 5.14×10^{21}

(3) 2.57×10^{21} (4) 1.03×10^{21}

37. The number of carbon atoms per unit cell of diamond unit cell is :

(1) 1 (2) 4

(3) 6 (4) 8

38. The number of close neighbour in a body centered cubic lattice of identical sphere is :

(1) 2 (2) 4

(3) 6 (4) 8

39. In face centered cubic unit cell, the edge length is :

(1) $\frac{4}{\sqrt{2}}r$ (2) $\frac{\sqrt{3}}{2}r$

(3) $\frac{4}{3}r$ (4) $2r$

40. The ratio of density of lattice points in (110) and (111) planes in a simple cubic lattice is :

(1) 1 : 1 (2) 1 : 2

(3) $\sqrt{3} : \sqrt{2}$ (4) $\sqrt{2} : \sqrt{3}$

41. The set of Miller Indices for a plane which cuts off intercepts in the ratio 2a:4b:1c is :

(1) (214) (2) (241)

(3) (124) (4) (142)

42. If a plane makes intersects of 2, 1 and 0.5 Å on the crystallographic axes of an orthorhombic crystal with a:b:c = 3:2:1, then the Miller indices of this plane are :

(1) (421) (2) (344)

(3) (433) (4) (321)

43. Which of the following has the least packing fraction ?

(1) Simple cubic structure

(2) Body centered cubic structure

(3) Face centered cubic structure

(4) Diamond structure

44. The volume of the primitive unit cell of *fcc* structure with a lattice constant a is :

(1) $\frac{a^3}{8}$ (2) $\frac{a^3}{4}$

(3) $\frac{a^3}{2}$ (4) a^3

45. Which of the following is ***not*** true regarding wavelength of X-rays used in X-ray diffraction method ?

(1) When the wavelength of the X-rays is much smaller than the interplanar spacing then the X-rays are diffracted through angles which are too smart to be measured experimentally.

(2) X-rays having wavelength equal to the interplanar spacing are appropriate for X-ray diffraction

(3) X-rays having wavelength just greater than twice the interplanar spacing are most appropriate for x-ray diffraction

(4) Both (1) &(2).

46. The wavelength corresponding to the maximum intensity emitted by a body is :

(1) directly proportional to the temperature of the body

(2) inversely proportional to the temperature of the body

(3) directly proportional to the 4th power of the temperature of the body

(4) inversely proportional to the 4th power of the temperature of the body

47. The phenomenon known as Bose-Einstein condensation was invoked by F. London to explain :

(1) the free electron theory

(2) superfluidity exhibited by liquid ^3He

(3) the Planck's radiation law

(4) London equation

48. Which of the following statistics is classical statistics ?

(1) Maxwell-Boltzmann statistics

(2) Bose-Einstein statistics

(3) Fermi-Dirac statistics

(4) Both (1) and (3)

49. The minimum volume of phase space cell in Fermi-Dirac statistics is equal to :

(1) h^3 (2) h^3

(3) zero (4) $\frac{h^3}{c}$

50. Stefan's constant depends upon :

(1) Energy radiated per unit area per second

(2) Temperature of the black body

(3) Both (1)&(2)

(4) Does not depend upon (1)&(2)

51. The particles describe by antisymmetric wave functions are known as :

(1) Photons (2) Fermions

(3) Bosons (4) Gravitons

52. In case of Fermi-Dirac statistics, all particles cannot come down to the ground state due to :

(1) Pauli's exclusion principle

(2) Heisenberg uncertainty principal

(3) Gibb's free energy principle

(4) Plank's law

53. If Two stars X and Y emit light of orange and yellow colours, respectively, then the temperature will be greater for

(1) X

(2) Y

(3) Both have same temperature

(4) Can't say anything

54. Six distinguishable particles are distributed in two compartments with equal a priori probability. Then the probability of the most probable microstate is :

(1) $\frac{15}{32}$ (2) $\frac{15}{64}$

(3) $\frac{5}{16}$ (4) $\frac{5}{32}$

55. The Fourier transform, $F(k)$ of the function $f(x) = e^{-|x|}$ is :

(1) $\frac{1}{1+ik}$ (2) $\frac{1}{1-ik}$

(3) $\frac{2}{1+k^2}$ (4) $\frac{1}{1+k^2}$

56. If two lenses of focal lengths 9 cm and 3 cm are placed at a certain distance apart to form an achromatic combination, then the distance between the lenses is :

(1) 2.25 cm (2) 4.50 cm

(3) 6 cm (4) 12 cm

57. The aberrations produced by the variation of refractive index with wavelength of light are called :

(1) Spherical aberrations

(2) chromatic aberrations

(3) astigmatism

(4) none of the above

58. Which of the following is the result of varying magnification of rays refracted through different zones of the lens ?

(1) Coma

(2) Astigmatism

(3) Hypermetropia

(4) Myopia

59. In the construction of Fresnel's biprism two acute angled prisms are placed to base. Actually, it is constructed as a single prism of obtuse angle of about :

(1) 180°
(2) 179°
(3) 178°
(4) 177°

60. If the central fringe is displaced to the position, which was occupied by Ist bright fringe on placing a thin mica sheet of thickness 1.2 μm in the path of one of the interfering beams in a biprism arrangement, then the refractive index of mica sheet will be (wavelength of light used is 6000 Å) :

(1) 1.4
(2) 1.5
(3) 1.6
(4) 1.7

61. According to Lloyd's single mirror experiment, a light wave after reflection from an optically denser medium undergoes a phase change of :

(1) $\frac{\pi}{2}$
(2) π
(3) $\frac{3\pi}{2}$
(4) 2π

62. The ratio of adiabatic to isochoric pressure coefficient of expansion of a gas is $\left(\gamma = \frac{C_p}{C_v}\right)$:

(1) γ
(2) $\frac{\gamma}{\gamma+1}$
(3) $\frac{\gamma}{\gamma-1}$
(4) $\frac{1}{\gamma}$

63. Which of the following is called first latent heat equation ? (where symbols have usual meaning)

(1) $\frac{dP}{dT} = \frac{L}{T(V_2 - V_1)}$
(2) $\frac{dP}{dT} = \frac{LT}{(V_2 - V_1)}$
(3) $\frac{dP}{dT} = \frac{L(V_2 - V_1)}{T}$
(4) $\frac{dP}{dT} = \frac{T(V_2 - V_1)}{L}$

64. Which of the following is ***not*** a thermodynamical potential ?

(1) Internal energy

(2) Entropy

(3) Enthalpy

(4) Helmholtz free energy

65. One mole of an ideal gas at an initial temperature of T Kelvin does 6R Joule of work adiabatically. If the ratio specific heats of this gas at constant pressure and at constant volume is 5/3, the final temperature of the gas will be :

(1) (T+4) K

(2) (T-4) K

(3) (T+10) K

(4) (T–10) K

66. When a gas passes through a porous plan heating effect takes place :

(1) If temperature of the gas is less than its temperature of inversion

(2) If temperature of the gas is equal to its temperature of inversion

(3) If temperature of gas is more than its temperature of inversion

(4) None of the above

67. Which of the following is scientific language of computer ?

(1) PASCAL

(2) FORTRAN

(3) BASIC

(4) COBOL

68. During an adiabatic reversible process, the entropy :

(1) increases

(2) decreases

(3) first increases then decreases

(4) remains constant

69. What is the efficiency of a Carnot's engine working between the steam point and the ice point ?

(1) 26.81 %
(2) 33.29%
(3) 43.47%
(4) 100%

70. An oscillator consists :

(a) of a positive feedback amplifier
(b) has noise as the initial signal
(c) consists of a noise selecting network
(d) consists of a noise injecting network

Which of the above statements are ***correct*** ?

(1) a & d
(2) b & d
(3) a, b & c
(4) b, c & d

71. Voltage gain is highest in :

(1) Common base amplifier
(2) Common collector amplifier
(3) Common emitter amplifier
(4) A Diode in forward bias

72. In a common base amplifier, if the emitter current is 2 mA and current gain is 0.99 then base current is :

(1) 1.98 mA
(2) 2.02 mA
(3) 0.02 mA
(4) 0.2 mA

73. Which of the following is used for rectifying action ?

(1) Transistor
(2) Diode
(3) Capacitor
(4) Inductor

74. Which of the following is ***true*** in case of a PN junction diode ?
(1) In forward bias the current flows due to majority charge careers
(2) The width of the depletion region decreases in reverse bias
(3) The avalanche breakdown takes place in forward bias
(4) None of the above

75. Charge on a p-type semiconductor is :
(1) Positive
(2) Negative
(3) Zero
(4) 10^{-12} coulomb

76. The effective mass of an electron in a semiconductor :
(1) can never be negative
(2) can never be positive
(3) can be positive or negative
(4) depends on its spin

77. An ac generator produces an EMF of amplitude 22 V at a frequency 50 Hz, it is connected to a circuit containing 10 mH inductor. The current in the circuit is :
(1) $22 \sin\left(100\pi t + \frac{\pi}{2}\right)$
(2) $22 \sin\left(100\pi t - \frac{\pi}{2}\right)$
(3) $7 \sin\left(100\pi t + \frac{\pi}{2}\right)$
(4) $7 \sin\left(100\pi t - \frac{\pi}{2}\right)$

78. A Space ship is approaching a source of light with a speed equal to 0.5c (c is speed of light). Light coming from the source of light as seen by the observer in the space ship travels with a speed equal to :
(1) 0.5c
(2) c
(3) 1.5c
(4) 2c

79. The temperature at which the average speed of H_2 molecules will be same as that of N_2 molecules at 35°C will be :

(1) 2.5°C
(2) 6.25°C
(3) –50°C
(4) –251°C

80. The elastic fatigue distinctly illustrated in :

(1) Iron
(2) Silver
(3) Quartz
(4) Glass

81. The Young's modulus of a wire of length L and radius R is Y. If the length is reduced to L/2 and radius to R/ 2, it's Young's modulus will be :

(1) Y/2
(2) Y
(3) 2Y
(4) 4Y

82. Practical value of Poisson's ratio (σ) can be :

(1) Less than zero
(2) Between 0 and 0.5
(3) Between –1 and 0.5
(4) Greater than 0.5

83. The potential energy per unit volume for a body strained under a longitudinal strai shall be equal to :

(1) stress × strain
(2) stress × $(\text{strain})^2$
(3) 1/2 stress × $(\text{strain})^2$
(4) 1/2(stress × strain)

84. The Boltzmann's constant depends on :

(1) Temperature
(2) Volume and Temperature
(3) Pressure, volume and Temperature
(4) None of the above

85. The pressure exerted on the walls of the container by a gas is due to the fact that the gas molecules :

(1) lose their kinetic energy

(2) stick to the walls

(3) are accelerated towards the walls

(4) change their momenta due to collision with the walls

86. If a moving charge particle passes through region having random magnetic field, then the kinetic energy of the charge particle will :

(1) Increase

(2) Decrease

(3) Remain same

(4) Increase or decrease depending upon the nature of charge particle

87. If two long current carrying conductors are placed parallel to each other in free space and current is passing through both the conductors in same directions, then the force between them will be :

(1) Attractive (2) Repulsive

(3) No force (4) Can't say anything

88. The area of hysteresis loop for a ferromagnetic material represents :

(1) The square of magnetism per cycle

(2) Energy loss per cycle

(3) Coercivity

(4) Retentivity

89. The concept of displacement current was proposed by :

(1) Faraday

(2) Ampere

(3) Biot-Savart

(4) Maxwell

90. A charged capacitor (C) is connected in series with an inductor (L). When the displacement current reduces to zero, the energy of the LC circuit is :

(1) stored entirely in its magnetic field

(2) stored entirely in its electric field

(3) distributed equally among its electric and magnetic fields

(4) radiated out of the circuit

91. If $\phi = yz$, then its gradient is :

(1) $zi + yk$ (2) $yj + zk$

(3) $i + j + k$ (4) zero

92. The divergence of a position vector is :

(1) Zero (2) 1

(3) 3 (4) 9

93. A theorem that relates surface integral with the volume integral is called :

(1) Stocks theorem

(2) Carnot's theorem

(3) Greens theorem

(4) Gauss-divergence theorem

94. If a vector is solenoidal, then :

(1) $\overrightarrow{A} = 0$

(2) $\nabla . \overrightarrow{A} = 0$

(3) $\nabla \times \overrightarrow{A} = 0$

(4) $\nabla . \left(\nabla \times \overrightarrow{A}\right) = 0$

95. A disc, ring and sphere of the same radius are allowed to roll down an inclined plane from the same height without slipping, which one has highest kinetic energy ?

(1) Disc

(2) Ring

(3) Sphere

(4) All have same kinetic energy

96. The rate of change of linear momentum with respect to time is equal to :

(1) Torque

(2) Angular velocity

(3) Force

(4) Power

97. If the moment of inertia for a solid sphere about any diameter is $2/5MR^2$, then the moment of Inertia of the same sphere about a tangent is :

(1) $2/5\ MR^2$

(2) $3/5\ MR^2$

(3) $4/5\ MR^2$

(4) $7/5MR^2$

98. The ice skaters, ballet dancers, and dives often use the principle of conservation of :

(1) Mass and energy

(2) Linear momentum

(3) Angular momentum

(4) All of the above

99. The Lagrangian of an Atwood's machine is :

(1) $\frac{1}{2}(m_1 + m_2)\dot{x}^2 + (m_1 - m_2)gx - V_0$

(2) $\frac{1}{2}(m_1 + m_2)\dot{x}^2 + \frac{1}{2}(m_1 - m_2)gx - V_0$

(3) $(m_1 + m_2)\dot{x}^2 + (m_1 - m_2)gx - V_0$

(4) $\frac{1}{2}(m_1 + m_2)\dot{x}^2 + (m_1 + m_2)gx - V_0$

100. A cylinder of mass M and radius R is rolling down without sleeping on an incline plane of angle of inclination θ. The number of generalized coordinate required t describe the motion of the system :

(1) 1
(2) 2
(3) 4
(4) 6

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B

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10014

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   (3) Common emitter amplifier
   (4) A Diode in forward bias

2. In a common base amplifier, if the emitter current is 2 mA and current gain is 0.99, then base current is :
   (1) 1.98 mA (2) 2.02 mA
   (3) 0.02 mA (4) 0.2 mA

3. Which of the following is used for rectifying action ?
   (1) Transistor (2) Diode
   (3) Capacitor (4) Inductor

4. Which of the following is ***true*** in case of a PN junction diode ?
   (1) In forward bias the current flows due to majority charge careers
   (2) The width of the depletion region decreases in reverse bias
   (3) The avalanche breakdown takes place in forward bias
   (4) None of the above

5. Charge on a p-type semiconductor is :
   (1) Positive
   (2) Negative
   (3) Zero
   (4) 10^{-12} coulomb

6. The effective mass of an electron in a semiconductor :
   (1) can never be negative
   (2) can never be positive
   (3) can be positive or negative
   (4) depends on its spin

7. An ac generator produces an EMF of amplitude 22 V at a frequency 50 Hz, it is connected to a circuit containing 10 mH inductor. The current in the circuit is :

(1) $22 \sin\left(100\pi t + \frac{\pi}{2}\right)$

(2) $22 \sin\left(100\pi t - \frac{\pi}{2}\right)$

(3) $7 \sin\left(100\pi t + \frac{\pi}{2}\right)$

(4) $7 \sin\left(100\pi t - \frac{\pi}{2}\right)$

8. A Space ship is approaching a source of light with a speed equal to 0.5c (c is speed of light). Light coming from the source of light as seen by the observer in the space ship travels with a speed equal to :

(1) 0.5c

(2) c

(3) 1.5c

(4) 2c

9. The temperature at which the average speed of H_2 molecules will be same as that of N2 molecules at 35°C will be :

(1) 2.5°C

(2) 6.25°C

(3) –50°C

(4) –251°C

10. The elastic fatigue distinctly illustrated in :

(1) Iron

(2) Silver

(3) Quartz

(4) Glass

11. The particles describe by antisymmetric wave functions are known as :

(1) Photons

(2) Fermions

(3) Bosons

(4) Gravitons

12. In case of Fermi-Dirac statistics, all particles cannot come down to the ground state due to :

(1) Pauli's exclusion principle

(2) Heisenberg uncertainty principal

(3) Gibb's free energy principle

(4) Plank's law

13. If Two stars X and Y emit light of orange and yellow colours, respectively, then the temperature will be greater for

(1) X

(2) Y

(3) Both have same temperature

(4) Can't say anything

14. Six distinguishable particles are distributed in two compartments with equal a priori probability. Then the probability of the most probable microstate is :

(1) $\frac{15}{32}$ (2) $\frac{15}{64}$

(3) $\frac{5}{16}$ (4) $\frac{5}{32}$

15. The Fourier transform, $F(k)$ of the function $f(x) = e^{-|x|}$ is :

(1) $\frac{1}{1+ik}$ (2) $\frac{1}{1-ik}$

(3) $\frac{2}{1+k^2}$ (4) $\frac{1}{1+k^2}$

16. If two lenses of focal lengths 9 cm and 3 cm are placed at a certain distance apart to form an achromatic combination, then the distance between the lenses is :

(1) 2.25 cm (2) 4.50 cm

(3) 6 cm (4) 12 cm

17. The aberrations produced by the variation of refractive index with wavelength of light are called :

(1) Spherical aberrations

(2) chromatic aberrations

(3) astigmatism

(4) none of the above

18. Which of the following is the result of varying magnification of rays refracted through different zones of the lens ?

(1) Coma

(2) Astigmatism

(3) Hypermetropia

(4) Myopia

19. In the construction of Fresnel's biprism two acute angled prisms are placed to base. Actually, it is constructed as a single prism of obtuse angle of about :

(1) 180° (2) 179°

(3) 178° (4) 177°

20. If the central fringe is displaced to the position, which was occupied by lst bright fringe on placing a thin mica sheet of thickness 1.2 μm in the path of one of the interfering beams in a biprism arrangement, then the refractive index of mica sheet will be (wavelength of light used is 6000 Å) :

(1) 1.4 (2) 1.5

(3) 1.6 (4) 1.7

21. What should bc the velocity of an electron so that its linear momentum becomes equal to that of a photon of wavelength 10 Å ?

(1) 3×10^8 ms ^{1} (2) $3 \times 10^7 ms^{-1}$

(3) $7.27 \times 10^6 ms^{-1}$ (4) $7.27 \times 10^5 ms^{-1}$

22. An electron is accelerated from rest through a potential difference of 200 v. If e/m for electron is 1.6×10^{11} C/Kg, the speed acquired by the electron will be :

(1) $8 \times 10^6 ms^{-1}$

(2) $8 \times 10^5 ms^{-1}$

(3) $5.656 \times 10^6 ms^{-1}$

(4) $5.656 \times 10^5 ms^{-1}$

23. According to Debye theory, the specific heat of solids at low temperature is proportional to :

(1) T^0 (2) T

(3) T^2 (4) T^3

24. Which of the following is not correct with regard to Debye approximation ?

(1) Debye theory obeys Doulong and Petit's law at high temperatures.

(2) The quantum considerations carry great significance at high temperatures.

(3) At low temperatures the phonons obey same statistics as that obeyed by photons at all temperatures.

(4) The specific heat of solids is proportional to T^3 at low temperatures.

25. How many space Lattices can be obtained from the different crystal systems ?

(1) 8 (2) 14

(3) 32 (4) 230

26. How many unit cells are present in a cube - shaped ideal crystal of NaCl of mass 1g ? [Atomic mass of Na and Cl are 23 and 35.5, respectively]

(1) 1.03×10^{22} (2) 5.14×10^{21}

(3) 2.57×10^{21} (4) 1.03×10^{21}

27. The number of carbon atoms per unit cell of diamond unit cell is :

(1) 1 (2) 4

(3) 6 (4) 8

28. The number of close neighbour in a body centered cubic lattice of identical sphere is :

(1) 2 (2) 4

(3) 6 (4) 8

29. In face centered cubic unit cell, the edge length is :

(1) $\frac{4}{\sqrt{2}}r$ (2) $\frac{\sqrt{3}}{2}r$

(3) $\frac{4}{3}r$ (4) $2r$

30. The ratio of density of lattice points in (110) and (111) planes in a simple cubic lattice is :

(1) 1 : 1 (2) 1 : 2

(3) $\sqrt{3} : \sqrt{2}$ (4) $\sqrt{2} : \sqrt{3}$

31. The ratio of the longest wavelength and the shortest wavelength observed in high spectral series of the emission spectrum of hydrogen is :

(1) 4/3 (2) 525/376

(3) 25/1 (4) 36/1

32. The selection rules for passing back effect are :

(1) $\Delta m_j = 0$

(2) $\Delta m_j = 0, \pm 1$

(3) $\Delta m_j = 0, \pm 1, \Delta m_s = 0$

(4) $\Delta m_j = 0, \pm 1, \Delta m_s = 0, \pm 1$

33. The possible values of magnetic quantum number for each l are given by :

(1) $2l - 1$, (2) $2l + 1$,

(3) $l - 2$, (4) $l + 1$

34. The splitting of a single line singlet into three component lines in the presence of magnetic field is :

(1) Paschen-Back effect

(2) Normal Zeeman effect

(3) Anomalous Zeeman Effect

(4) Joule-Kelvin effect

35. The possible values of Jz for $^2D_{3/2}$ state of an electron are :

(1) $\frac{3}{2}\hbar; \frac{1}{2}\hbar; \frac{-3}{2}\hbar; \frac{-5}{2}\hbar$

(2) $\frac{3}{2}\hbar; \frac{1}{2}\hbar; \frac{-1}{2}\hbar; \frac{-3}{2}\hbar$

(3) $\frac{5}{2}\hbar; \frac{3}{2}\hbar; \frac{-3}{2}\hbar; \frac{-5}{2}\hbar$

(4) $\frac{5}{2}\hbar; \frac{3}{2}\hbar; \frac{1}{2}\hbar; \frac{-1}{2}\hbar$

36. The full form of laser is :

(1) Light Amplification of Stimulated Emission Radiation

(2) Light Amplification of Spontaneous Emission Radiation

(3) Light Amplification by Spontaneous Emission of Radiation

(4) Light Amplification by Stimulated Emission of Radiation

37. The coherence length of a laser beam with wavelength 440nm and coherence time 40μs is :

(1) 11 Km

(2) 12 Km

(3) 1.1 m

(4) 1.2 Km

38. If the distance between two plane mirrors forming the resonant cavity is 0.3 m, then the difference between frequencies of consecutive modes will be :

(1) 500MHz

(2) 100MHz

(3) 5MHz

(4) IMHz

39. The function of Helium atom in the Helium-Neon laser is :

(1) to provide energy to the Neon atoms

(2) to quench the Neon atoms

(3) to make Neon atoms inactive

(4) none of the above

40. In ruby laser, the rod is surrounded by a helical photographic flash lamp filled with :

(1) neon

(2) xenon

(3) aluminum

(4) chromium

41. If $\phi = yz$, then its gradient is :

(1) $zi + yk$

(2) $yj + zk$

(3) $i + j + k$

(4) zero

42. The divergence of a position vector is :

(1) Zero

(2) 1

(3) 3

(4) 9

43. A theorem that relates surface integral with the volume integral is called :

(1) Stocks theorem

(2) Carnot's theorem

(3) Greens theorem

(4) Gauss-divergence theorem

44. If a vector is solenoidal, then :

(1) $\overrightarrow{A} = 0$

(2) $\nabla . \overrightarrow{A} = 0$

(3) $\nabla \times \overrightarrow{A} = 0$

(4) $\nabla . \left(\nabla \times \overrightarrow{A}\right) = 0$

45. A disc, ring and sphere of the same radius are allowed to roll down an inclined plane from the same height without slipping, which one has highest kinetic energy ?

(1) Disc

(2) Ring

(3) Sphere

(4) All have same kinetic energy

46. The rate of change of linear momentum with respect to time is equal to :

(1) Torque

(2) Angular velocity

(3) Force

(4) Power

47. If the moment of inertia for a solid sphere about any diameter is $2/5MR^2$, then the moment of Inertia of the same sphere about a tangent is :

(1) $2/5\ MR^2$

(2) $3/5\ MR^2$

(3) $4/5\ MR^2$

(4) $7/5MR^2$

48. The ice skaters, ballet dancers, and dives often use the principle of conservation of :

(1) Mass and energy

(2) Linear momentum

(3) Angular momentum

(4) All of the above

49. The Lagrangian of an Atwood's machine is :

(1) $\frac{1}{2}(m_1+m_2)\dot{x}^2+(m_1-m_2)gx-V_0$

(2) $\frac{1}{2}(m_1+m_2)\dot{x}^2+\frac{1}{2}(m_1-m_2)gx-V_0$

(3) $(m_1+m_2)\dot{x}^2+(m_1-m_2)gx-V_0$

(4) $\frac{1}{2}(m_1+m_2)\dot{x}^2+(m_1+m_2)gx-V_0$

50. A cylinder of mass M and radius R is rolling down without sleeping on an inclined plane of angle of inclination θ. The number of generalized coordinate required to describe the motion of the system :

(1) 1 (2) 2

(3) 4 (4) 6

51. According to Lloyd's single mirror experiment, a light wave after reflection from an optically denser medium undergoes a phase change of :

(1) $\frac{\pi}{2}$ (2) π

(3) $\frac{3\pi}{2}$ (4) 2π

52. The ratio of adiabatic to isochoric pressure coefficient of expansion of a gas is $\left(\gamma=\frac{C_p}{C_v}\right)$:

(1) γ (2) $\frac{\gamma}{\gamma+1}$

(3) $\frac{\gamma}{\gamma-1}$ (4) $\frac{1}{\gamma}$

53. Which of the following is called first latent heat equation ? (where symbols have usual meaning)

(1) $\frac{dP}{dT} = \frac{L}{T(V_2 - V_1)}$ (2) $\frac{dP}{dT} = \frac{LT}{(V_2 - V_1)}$

(3) $\frac{dP}{dT} = \frac{L(V_2 - V_1)}{T}$ (4) $\frac{dP}{dT} = \frac{T(V_2 - V_1)}{L}$

54. Which of the following is ***not*** a thermodynamical potential ?

(1) Internal energy

(2) Entropy

(3) Enthalpy

(4) Helmholtz free energy

55. One mole of an ideal gas at an initial temperature of T Kelvin does 6R Joule of work adiabatically. If the ratio specific heats of this gas at constant pressure and at constant volume is 5/3, the final temperature of the gas will be :

(1) (T+4) K

(2) (T-4) K

(3) (T+10) K

(4) (T–10) K

56. When a gas passes through a porous plan heating effect takes place :

(1) If temperature of the gas is less than its temperature of inversion

(2) If temperature of the gas is equal to its temperature of inversion

(3) If temperature of gas is more than its temperature of inversion

(4) None of the above

57. Which of the following is scientific language of computer ?

(1) PASCAL

(2) FORTRAN

(3) BASIC

(4) COBOL

58. During an adiabatic reversible process, the entropy :

(1) increases

(2) decreases

(3) first increases then decreases

(4) remains constant

59. What is the efficiency of a Carnot's engine working between the steam point and the ice point ?

(1) 26.81 %

(2) 33.29%

(3) 43.47%

(4) 100%

60. An oscillator consists :

(a) of a positive feedback amplifier

(b) has noise as the initial signal

(c) consists of a noise selecting network

(d) consists of a noise injecting network

Which of the above statements are ***correct*** ?

(1) a & d

(2) b & d

(3) a, b & c

(4) b, c & d

61. The Young's modulus of a wire of length L and radius R is Y. If the length is reduced to L/2 and radius to R/ 2, it's Young's modulus will be :

(1) Y/2

(2) Y

(3) 2Y

(4) 4Y

62. Practical value of Poisson's ratio (σ) can be :

(1) Less than zero

(2) Between 0 and 0.5

(3) Between -1 and 0.5

(4) Greater than 0.5

63. The potential energy per unit volume for a body strained under a longitudinal strain shall be equal to :

(1) stress × strain

(2) stress × $(\text{strain})^2$

(3) 1/2 stress × $(\text{strain})^2$

(4) 1/2(stress × strain)

64. The Boltzmann's constant depends on :

(1) Temperature

(2) Volume and Temperature

(3) Pressure, volume and Temperature

(4) None of the above

65. The pressure exerted on the walls of the container by a gas is due to the fact that the gas molecules :

(1) lose their kinetic energy

(2) stick to the walls

(3) are accelerated towards the walls

(4) change their momenta due to collision with the walls

66. If a moving charge particle passes through region having random magnetic field, then the kinetic energy of the charge particle will :

(1) Increase

(2) Decrease

(3) Remain same

(4) Increase or decrease depending upon the nature of charge particle

67. If two long current carrying conductors are placed parallel to each other in free space and current is passing through both the conductors in same directions, then the force between them will be :

(1) Attractive

(2) Repulsive

(3) No force

(4) Can't say anything

68. The area of hysteresis loop for a ferromagnetic material represents :

(1) The square of magnetism per cycle

(2) Energy loss per cycle

(3) Coercivity

(4) Retentivity

69. The concept of displacement current was proposed by :

(1) Faraday

(2) Ampere

(3) Biot-Savart

(4) Maxwell

70. A charged capacitor (C) is connected in series with an inductor (L). When the displacement current reduces to zero, the energy of the LC circuit is :

(1) stored entirely in its magnetic field

(2) stored entirely in its electric field

(3) distributed equally among its electric and magnetic fields

(4) radiated out of the circuit

71. The set of Miller Indices for a plane which cuts off intercepts in the ratio 2a:4b:1 is :

(1) (214) (2) (241)

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72. If a plane makes intersects of 2, 1 and 0.5 Å on the crystallographic axes of a orthorhombic crystal with a:b:c = 3:2:1, then the Miller indices of this plane are :

(1) (421) (2) (344)

(3) (433) (4) (321)

73. Which of the following has the least packing fraction ?

(1) Simple cubic structure

(2) Body centered cubic structure

(3) Face centered cubic structure

(4) Diamond structure

74. The volume of the primitive unit cell of *fcc* structure with a lattice constant a is :

(1) $\frac{a^3}{8}$ (2) $\frac{a^3}{4}$

(3) $\frac{a^3}{2}$ (4) a^3

75. Which of the following is ***not*** true regarding wavelength of X-rays used in X-ray diffraction method ?

(1) When the wavelength of the X-rays is much smaller than the interplanar spacing then the X-rays are diffracted through angles which are too smart to be measured experimentally.

(2) X-rays having wavelength equal to the interplanar spacing are appropriate for X-ray diffraction

(3) X-rays having wavelength just greater than twice the interplanar spacing are most appropriate for x-ray diffraction

(4) Both (1) &(2).

76. The wavelength corresponding to the maximum intensity emitted by a body is :

(1) directly proportional to the temperature of the body

(2) inversely proportional to the temperature of the body

(3) directly proportional to the 4th power of the temperature of the body

(4) inversely proportional to the 4th power of the temperature of the body

77. The phenomenon known as Bose-Einstein condensation was invoked by F. London to explain :

(1) the free electron theory

(2) superfluidity exhibited by liquid ^{3}He

(3) the Planck's radiation law

(4) London equation

78. Which of the following statistics is classical statistics ?

(1) Maxwell-Boltzmann statistics

(2) Bose-Einstein statistics

(3) Fermi-Dirac statistics.

(4) Both (1) and (3)

79. The minimum volume of phase space cell in Fermi-Dirac statistics is equal to :

(1) $\hbar^3$ (2) h^3

(3) zero (4) $\frac{h^3}{c}$

80. Stefan's constant depends upon :

(1) Energy radiated per unit area per second

(2) Temperature of the black body

(3) Both (1)&(2)

(4) Does not depend upon (1)&(2)

81. The energy of the lowest state in one dimensional box of length a is :

(1) Zero (2) $\frac{h}{4ma^2}$

(3) $\frac{h}{8ma^2}$ (4) $\frac{h^2}{8ma^2}$

82. The wavefunction of a particle is given by :

$\psi = Ae^{-kx}$ for $0 < x < \infty$
$= 0$ for $-\infty < x < 0$

The value of A is :

(1) $\sqrt{\frac{k}{2}}$ (2) $\sqrt{k}$

(3) $\sqrt{\frac{2}{k}}$ (4) $\sqrt{\frac{1}{k}}$

83. In one dimensional potential box of length a, the probability of finding a particle will be maximum at :

(1) Zero (2) $\frac{a}{4}$

(3) $\frac{a}{2}$ (4) a

84. According to Schrödinger, a particle is equivalent to :

(1) A sound wave
(2) A wave packet
(3) A light wave
(4) A single wave

85. An eigenfunction of an operator $\frac{d^2}{dx^2}$ is e^{ax}. The corresponding eigenvalue will be :

(1) 1 (2) $\alpha^{0.5}$

(3) α (4) α^2

86. If an electron, a proton, and a neutron have same de-Broglie wavelength, then which particle has greater velocity ?

(1) Election
(2) Proton
(3) Neutron
(4) All have same velocity

87. If an α-particle and a proton have same kinetic energy, then the ratio wavelengths of the α - particle and the proton will be

(1) 1 : 2 (2) 1 : 4

(3) 2 : 1 (4) 4 : 1

88. The linear momentum of a photon with weavelength λ will be :

(1) Zero (2) $\frac{h}{\lambda}$

(3) $\frac{h}{\lambda^2}$ (4) $\frac{h}{c\lambda}$

89. The threshold wavelength of sodium metal is 6800 Å. The work function of sodiu metal is :

(1) 0.91 eV (2) 1.82eV

(3) 2.27eV (4) 3.64eV

90. If the uncertainty in the position of an electron is 1 Å, then the value of uncertainty its momentum will be :

(1) $6.6 \times 10^{-34} Kgms^{-1}$ (2) $2.2 \times 10^{-34} Kgms^{-1}$

(3) $3.33 \times 10^{-24} Kgms^{-1}$ (4) $1.03 \times 10^{-24} Kgms^{-1}$

91. The width of the plateau region in a GM counter depends upon :

(1) Type of radiation

(2) Energy of radiation

(3) Both (1) and (2)

(4) None of the above

92. Which of the following is a better material for shielding of Beta radiations ?

(1) Aluminum (2) Lead

(3) Platinum (4) Bismuth

93. The reaction time for a direct nuclear reaction is of the order of :

(1) 10^{-10} second

(2) 10^{-15} second

(3) 10^{-20} second

(4) 10^{-30} second

94. Which of the following is not true about Alpha emission ?

(1) The atomic number of parent nucleus decreased by 2 after Alpha mission.

(2) The mass number of parent nucleus decreased by 4 after Alpha mission.

(3) The Alpha emission spectrum is a continuous spectrum.

(4) The most energetic Alpha particles are emitted from Polonium-212.

95. The energy of a thermal neutron at 27°C is :

(1) 0.026eV

(2) 0.26eV

(3) 2.6eV

(4) 26eV

96. The density of the nucleus is of the order of :

(1) 10^{12}Kgm^{-3}

(2) 10^{17}Kgm^{-3}

(3) 10^{22} Kgm^{-3}

(4) 10^{27} Kgm^{-3}

97. Beta decay is a consequence of :

(1) strong nuclear force

(2) electromagnetic force

(3) weak nuclear force

(4) gravitational force

98. The number of electron-ion pairs created by a Gamma radiation of energy 1 MeV in gas having ionization potential equal to 25 V is :

(1) 6.4×10^6

(2) 6.4×10^4

(3) 4×10^6

(4) 4×10^4

99. The minimum energy of photon required for pair production is :

(1) 1.022 eV

(2) 1.022 KeV

(3) 1.022 MeV

(4) 511 KeV

100. In terms of Redburg's constant (R), the wave number of first Balmer line is :

(1) R

(2) 3R/4

(3) 5R/36

(4) 8R/9

Total No. of Printed Pages : 21

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C

SET-Y

PG-EE-July, 2024

SUBJECT : Physics

Sr. No. 10003

Time : **1¼ Hours** Max. Marks : **100** Total Questions : **100**

Roll No. (in figures)_____ (in words) _____

Name _____ Date of Birth_____

Father's Name _____ Mother's Name_____

Date of Examination _____

_____ _____

(Signature of the Candidate) (Signature of the Invigilator)

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2. The candidates ***must return*** the question booklet as well as OMR Answer-Sheet to the Invigilator concerned before leaving the Examination Hall, failing which a case of use of unfair-means / mis-behaviour will be registered against him / her, in addition to lodging of an FIR with the police. Further the answer-sheet of such a candidate will not be evaluated.
3. Keeping in view the transparency of the examination system, carbonless OMR Sheet is provided to the candidate so that a copy of OMR Sheet may be kept by the candidate.
4. Question Booklet along with answer key of all the A, B, C & D code shall be got uploaded on the University Website immediately after the conduct of Entrance Examination. Candidates may raise valid objection/complaint if any, with regard to discrepancy in the question booklet/answer key within 24 hours of uploading the same on the University Website. The complaint be sent by the students to the Controller of Examinations by hand or through email. Thereafter, no complaint in any case, will be considered.
5. The candidate ***must not*** do any rough work or writing in the OMR Answer-Sheet. Rough work, if any, may be done in the question booklet itself. Answers ***must not*** be ticked in the question booklet.
6. ***There will be no negative marking. Each correct answer will be awarded one full mark. Cutting, erasing, overwriting and more than one answer in OMR Answer-Sheet will be treated as incorrect answer.***
7. Use only **Black** or **Blue Ball Point Pen** of good quality in the OMR Answer-Sheet.
8. *Before answering the questions, the candidates should ensure that they have been supplied correct and complete booklet. Complaints, if any, regarding misprinting etc. will not be entertained* **30** *minutes after starting of the examination.*

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   (3) Both (1)&(2)
   (4) Does not depend upon (1)&(2)

11. The energy of the lowest state in one dimensional box of length a is :

(1) Zero

(2) $\frac{h}{4ma^2}$

(3) $\frac{h}{8ma^2}$

(4) $\frac{h^2}{8ma^2}$

12. The wavefunction of a particle is given by :

$\psi = Ae^{-kx}$ for $0 < x < \infty$

$= 0$ for $-\infty < x < 0$

The value of Λ is :

(1) $\sqrt{\frac{k}{2}}$

(2) $\sqrt{k}$

(3) $\sqrt{\frac{2}{k}}$

(4) $\sqrt{\frac{1}{k}}$

13. In one dimensional potential box of length a, the probability of finding a particle will be maximum at :

(1) Zero

(2) $\frac{a}{4}$

(3) $\frac{a}{2}$

(4) a

14. According to Schrödinger, a particle is equivalent to :

(1) A sound wave

(2) A wave packet

(3) A light wave

(4) A single wave

15. An eigenfunction of an operator $\frac{d^2}{dx^2}$ is e^{ax}. The corresponding eigenvalue will be :

(1) 1 (2) $\alpha^{0.5}$

(3) α (4) α^2

16. If an electron, a proton, and a neutron have same de-Broglie wavelength, then which particle has greater velocity ?

(1) Election

(2) Proton

(3) Neutron

(4) All have same velocity

17. If an α-particle and a proton have same kinetic energy, then the ratio wavelengths of the α- particle and the proton will be

(1) 1 : 2 (2) 1 : 4

(3) 2 : 1 (4) 4 : 1

18. The linear momentum of a photon with weavelength λ will be :

(1) Zero (2) $\frac{h}{\lambda}$

(3) $\frac{h}{\lambda^2}$ (4) $\frac{h}{c\lambda}$

19. The threshold wavelength of sodium metal is 6800 Å. The work function of sodium metal is :

(1) 0.91 eV (2) 1.82eV

(3) 2.27eV (4) 3.64eV

20. If the uncertainty in the position of an electron is 1 Å, then the value of uncertainty in its momentum will be :

(1) $6.6 \times 10^{-34} Kgms^{-1}$ (2) $2.2 \times 10^{-34} Kgms^{-1}$

(3) $3.33 \times 10^{-24} Kgms^{-1}$ (4) $1.03 \times 10^{-24} Kgms^{-1}$

21. The width of the plateau region in a GM counter depends upon :
(1) Type of radiation
(2) Energy of radiation
(3) Both (1) and (2)
(4) None of the above

22. Which of the following is a better material for shielding of Beta radiations ?
(1) Aluminum
(2) Lead
(3) Platinum
(4) Bismuth

23. The reaction time for a direct nuclear reaction is of the order of :
(1) 10^{-10} second
(2) 10^{-15} second
(3) 10^{-20} second
(4) 10^{-30} second

24. Which of the following is not true about Alpha emission ?
(1) The atomic number of parent nucleus decreased by 2 after Alpha mission.
(2) The mass number of parent nucleus decreased by 4 after Alpha mission.
(3) The Alpha emission spectrum is a continuous spectrum.
(4) The most energetic Alpha particles are emitted from Polonium-212.

25. The energy of a thermal neutron at 27°C is :
(1) 0.026eV
(2) 0.26eV
(3) 2.6eV
(4) 26eV

26. The density of the nucleus is of the order of :

(1) 10^{12}Kgm^{-3} (2) 10^{17}Kgm^{-3}

(3) 10^{22} Kgm^{-3} (4) 10^{27} Kgm^{-3}

27. Beta decay is a consequence of :

(1) strong nuclear force

(2) electromagnetic force

(3) weak nuclear force

(4) gravitational force

28. The number of electron-ion pairs created by a Gamma radiation of energy 1 MeV in a gas having ionization potential equal to 25 V is :

(1) 6.4×10^6 (2) 6.4×10^4

(3) 4×10^6 (4) 4×10^4

29. The minimum energy of photon required for pair production is :

(1) 1.022 eV

(2) 1.022 KeV

(3) 1.022 MeV

(4) 511 KeV

30. In terms of Redburg's constant (R), the wave number of first Balmer line is :

(1) R

(2) 3R/4

(3) 5R/36

(4) 8R/9

31. If $\phi = yz$, then its gradient is :

(1) $zi + yk$ (2) $yj + zk$

(3) $i + j + k$ (4) zero

32. The divergence of a position vector is :

(1) Zero (2) 1

(3) 3 (4) 9

33. A theorem that relates surface integral with the volume integral is called :

(1) Stocks theorem

(2) Carnot's theorem

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(1) $\overrightarrow{A} = 0$

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35. A disc, ring and sphere of the same radius are allowed to roll down an inclined plane from the same height without slipping, which one has highest kinetic energy ?

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36. The rate of change of linear momentum with respect to time is equal to :

(1) Torque

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37. If the moment of inertia for a solid sphere about any diameter is $2/5MR^2$, then the moment of Inertia of the same sphere about a tangent is :

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38. The ice skaters, ballet dancers, and dives often use the principle of conservation of :

(1) Mass and energy

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39. The Lagrangian of an Atwood's machine is :

(1) $\frac{1}{2}(m_1+m_2)\dot{x}^2+(m_1-m_2)gx-V_0$

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(4) $\frac{1}{2}(m_1+m_2)\dot{x}^2+(m_1+m_2)gx-V_0$

40. A cylinder of mass M and radius R is rolling down without sleeping on an inclined plane of angle of inclination θ. The number of generalized coordinate required to describe the motion of the system :

(1) 1 (2) 2

(3) 4 (4) 6

41. According to Lloyd's single mirror experiment, a light wave after reflection from an optically denser medium undergoes a phase change of :

(1) $\frac{\pi}{2}$ (2) π

(3) $\frac{3\pi}{2}$ (4) 2π

42. The ratio of adiabatic to isochoric pressure coefficient of expansion of a gas is $\left(\gamma = \frac{C_p}{C_v}\right)$:

(1) γ (2) $\frac{\gamma}{\gamma+1}$

(3) $\frac{\gamma}{\gamma-1}$ (4) $\frac{1}{\gamma}$

43. Which of the following is called first latent heat equation ? (where symbols have usual meaning)

(1) $\frac{dP}{dT} = \frac{L}{T(V_2 - V_1)}$

(2) $\frac{dP}{dT} = \frac{LT}{(V_2 - V_1)}$

(3) $\frac{dP}{dT} = \frac{L(V_2 - V_1)}{T}$

(4) $\frac{dP}{dT} = \frac{T(V_2 - V_1)}{L}$

44. Which of the following is ***not*** a thermodynamical potential ?

(1) Internal energy

(2) Entropy

(3) Enthalpy

(4) Helmholtz free energy

45. One mole of an ideal gas at an initial temperature of T Kelvin does 6R Joule o work adiabatically. If the ratio specific heats of this gas at constant pressure an at constant volume is 5/3, the final temperature of the gas will be :

(1) (T+4) K

(2) (T-4) K

(3) (T+10) K

(4) (T–10) K

46. When a gas passes through a porous plan heating effect takes place :

(1) If temperature of the gas is less than its temperature of inversion

(2) If temperature of the gas is equal to its temperature of inversion

(3) If temperature of gas is more than its temperature of inversion

(4) None of the above

47. Which of the following is scientific language of computer ?

(1) PASCAL

(2) FORTRAN

(3) BASIC

(4) COBOL

48. During an adiabatic reversible process, the entropy :

(1) increases

(2) decreases

(3) first increases then decreases

(4) remains constant

49. What is the efficiency of a Carnot's engine working between the steam point and the ice point ?

(1) 26.81 %

(2) 33.29%

(3) 43.47%

(4) 100%

50. An oscillator consists :

(a) of a positive feedback amplifier

(b) has noise as the initial signal

(c) consists of a noise selecting network

(d) consists of a noise injecting network

Which of the above statements are ***correct*** ?

(1) a & d (2) b & d

(3) a, b & c (4) b, c & d

51. What should be the velocity of an electron so that its linear momentum becomes equal to that of a photon of wavelength 10 Å ?

(1) 3×10^8 ms $^{-1}$ (2) $3 \times 10^7 ms^{-1}$

(3) $7.27 \times 10^6 ms^{-1}$ (4) $7.27 \times 10^5 ms^{-1}$

52. An electron is accelerated from rest through a potential difference of 200 v. If e/m for electron is 1.6×10^{11} C/Kg, the speed acquired by the electron will be :

(1) $8 \times 10^6 ms^{-1}$ (2) $8 \times 10^5 ms^{-1}$

(3) $5.656 \times 10^6 ms^{-1}$ (4) $5.656 \times 10^5 ms^{-1}$

53. According to Debye theory, the specific heat of solids at low temperature is proportional to :

(1) T^0 (2) T

(3) T^2 (4) T^3

54. Which of the following is not correct with regard to Debye approximation ?

(1) Debye theory obeys Doulong and Petit's law at high temperatures.

(2) The quantum considerations carry great significance at high temperatures.

(3) At low temperatures the phonons obey same statistics as that obeyed by photons at all temperatures.

(4) The specific heat of solids is proportional to T^3 at low temperatures.

55. How many space Lattices can be obtained from the different crystal systems ?

(1) 8 (2) 14

(3) 32 (4) 230

56. How many unit cells are present in a cube - shaped ideal crystal of NaCI of mass 1g ? [Atomic mass of Na and CI are 23 and 35.5, respectively]

(1) 1.03×10^{22} (2) 5.14×10^{21}

(3) 2.57×10^{21} (4) 1.03×10^{21}

57. The number of carbon atoms per unit cell of diamond unit cell is :

(1) 1 (2) 4

(3) 6 (4) 8

58. The number of close neighbour in a body centered cubic lattice of identical sphere is :

(1) 2 (2) 4

(3) 6 (4) 8

59. In face centered cubic unit cell, the edge length is :

(1) $\frac{4}{\sqrt{2}}r$ (2) $\frac{\sqrt{3}}{2}r$

(3) $\frac{4}{3}r$ (4) $2r$

60. The ratio of density of lattice points in (110) and (111) planes in a simple cubic lattice is :

(1) 1 : 1 (2) 1 : 2

(3) $\sqrt{3} : \sqrt{2}$ (4) $\sqrt{2} : \sqrt{3}$

61. Voltage gain is highest in :

(1) Common base amplifier (2) Common collector amplifier

(3) Common emitter amplifier (4) A Diode in forward bias

62. In a common base amplifier, if the emitter current is 2 mA and current gain is 0.99, then base current is :

(1) 1.98 mA
(2) 2.02 mA
(3) 0.02 mA
(4) 0.2 mA

63. Which of the following is used for rectifying action ?

(1) Transistor
(2) Diode
(3) Capacitor
(4) Inductor

64. Which of the following is ***true*** in case of a PN junction diode ?

(1) In forward bias the current flows due to majority charge careers
(2) The width of the depletion region decreases in reverse bias
(3) The avalanche breakdown takes place in forward bias
(4) None of the above

65. Charge on a p-type semiconductor is :

(1) Positive
(2) Negative
(3) Zero
(4) 10^{-12} coulomb

66. The effective mass of an electron in a semiconductor :

(1) can never be negative
(2) can never be positive
(3) can be positive or negative
(4) depends on its spin

67. An ac generator produces an EMF of amplitude 22 V at a frequency 50 Hz, it is connected to a circuit containing 10 mH inductor. The current in the circuit is :

(1) $22 \sin\left(100\pi t + \frac{\pi}{2}\right)$
(2) $22 \sin\left(100\pi t - \frac{\pi}{2}\right)$
(3) $7 \sin\left(100\pi t + \frac{\pi}{2}\right)$
(4) $7 \sin\left(100\pi t - \frac{\pi}{2}\right)$

68. A Space ship is approaching a source of light with a speed equal to 0.5c (c is speed of light). Light coming from the source of light as seen by the observer in the space ship travels with a speed equal to :

(1) 0.5c
(2) c
(3) 1.5c
(4) 2c

69. The temperature at which the average speed of H_2 molecules will be same as that of N_2 molecules at 35°C will be :

(1) 2.5°C
(2) 6.25°C
(3) –50°C
(4) –251°C

70. The elastic fatigue distinctly illustrated in :

(1) Iron
(2) Silver
(3) Quartz
(4) Glass

71. The Young's modulus of a wire of length L and radius R is Y. If the length is reduced to L/2 and radius to R/ 2, it's Young's modulus will be :

(1) Y/2
(2) Y
(3) 2Y
(4) 4Y

72. Practical value of Poisson's ratio (σ) can be :

(1) Less than zero
(2) Between 0 and 0.5
(3) Between –1 and 0.5
(4) Greater than 0.5

73. The potential energy per unit volume for a body strained under a longitudinal strain shall be equal to :

(1) stress × strain
(2) stress × $(\text{strain})^2$
(3) 1/2 stress × $(\text{strain})^2$
(4) 1/2(stress × strain)

74. The Boltzmann's constant depends on :

(1) Temperature

(2) Volume and Temperature

(3) Pressure, volume and Temperature

(4) None of the above

75. The pressure exerted on the walls of the container by a gas is due to the fact that the gas molecules :

(1) lose their kinetic energy

(2) stick to the walls

(3) are accelerated towards the walls

(4) change their momenta due to collision with the walls

76. If a moving charge particle passes through region having random magnetic field, then the kinetic energy of the charge particle will :

(1) Increase

(2) Decrease

(3) Remain same

(4) Increase or decrease depending upon the nature of charge particle

77. If two long current carrying conductors are placed parallel to each other in free space and current is passing through both the conductors in same directions, then the force between them will be :

(1) Attractive

(2) Repulsive

(3) No force

(4) Can't say anything

78. The area of hysteresis loop for a ferromagnetic material represents :

(1) The square of magnetism per cycle

(2) Energy loss per cycle

(3) Coercivity

(4) Retentivity

79. The concept of displacement current was proposed by :

(1) Faraday
(2) Ampere
(3) Biot-Savart
(4) Maxwell

80. A charged capacitor (C) is connected in series with an inductor (L). When the displacement current reduces to zero, the energy of the LC circuit is :

(1) stored entirely in its magnetic field
(2) stored entirely in its electric field
(3) distributed equally among its electric and magnetic fields
(4) radiated out of the circuit

81. The ratio of the longest wavelength and the shortest wavelength observed in high spectral series of the emission spectrum of hydrogen is :

(1) 4/3
(2) 525/376
(3) 25/1
(4) 36/1

82. The selection rules for passing back effect are :

(1) $\Delta m_j = 0$
(2) $\Delta m_j = 0, \pm 1$
(3) $\Delta m_j = 0, \pm 1, \Delta m_s = 0$
(4) $\Delta m_j = 0, \pm 1, \Delta m_s = 0, \pm 1$

83. The possible values of magnetic quantum number for each l are given by :

(1) $2l - 1$,
(2) $2l + 1$,
(3) $l - 2$,
(4) $l + 1$

84. The splitting of a single line singlet into three component lines in the presence o magnetic field is :

(1) Paschen-Back effect
(2) Normal Zeeman effect
(3) Anomalous Zeeman Effect
(4) Joule-Kelvin effect

85. The possible values of Jz for $^2D_{3/2}$ state of an electron are :

(1) $\frac{3}{2}\hbar; \frac{1}{2}\hbar; \frac{-3}{2}\hbar; \frac{-5}{2}\hbar$

(2) $\frac{3}{2}\hbar; \frac{1}{2}\hbar; \frac{-1}{2}\hbar; \frac{-3}{2}\hbar$

(3) $\frac{5}{2}\hbar; \frac{3}{2}\hbar; \frac{-3}{2}\hbar; \frac{-5}{2}\hbar$

(4) $\frac{5}{2}\hbar; \frac{3}{2}\hbar; \frac{1}{2}\hbar; \frac{-1}{2}\hbar$

86. The full form of laser is :

(1) Light Amplification of Stimulated Emission Radiation

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87. The coherence length of a laser beam with wavelength 440nm and coherence time 40μs is :

(1) 11 Km (2) 12 Km

(3) 1.1 m (4) 1.2 Km

88. If the distance between two plane mirrors forming the resonant cavity is 0.3 m, then the difference between frequencies of consecutive modes will be :

(1) 500MHz (2) 100MHz

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89. The function of Helium atom in the Helium-Neon laser is :

(1) to provide energy to the Neon atoms

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(3) to make Neon atoms inactive

(4) none of the above

90. In ruby laser, the rod is surrounded by a helical photographic flash lamp filled with :

(1) neon

(2) xenon

(3) aluminum

(4) chromium

91. The particles describe by antisymmetric wave functions are known as :

(1) Photons

(2) Fermions

(3) Bosons

(4) Gravitons

92. In case of Fermi-Dirac statistics, all particles cannot come down to the ground state du to :

(1) Pauli's exclusion principle

(2) Heisenberg uncertainty principal

(3) Gibb's free energy principle

(4) Plank's law

93. If Two stars X and Y emit light of orange and yellow colours, respectively, then t temperature will be greater for

(1) X

(2) Y

(3) Both have same temperature

(4) Can't say anything

94. Six distinguishable particles are distributed in two compartments with equal a priori probability. Then the probability of the most probable microstate is :

(1) $\frac{15}{32}$ (2) $\frac{15}{64}$

(3) $\frac{5}{16}$ (4) $\frac{5}{32}$

95. The Fourier transform, $F(k)$ of the function $f(x) = e^{-|x|}$ is :

(1) $\frac{1}{1+ik}$ (2) $\frac{1}{1-ik}$

(3) $\frac{2}{1+k^2}$ (4) $\frac{1}{1+k^2}$

96. If two lenses of focal lengths 9 cm and 3 cm are placed at a certain distance apart to form an achromatic combination, then the distance between the lenses is :

(1) 2.25 cm (2) 4.50 cm

(3) 6 cm (4) 12 cm

97. The aberrations produced by the variation of refractive index with wavelength of light are called :

(1) Spherical aberrations

(2) chromatic aberrations

(3) astigmatism

(4) none of the above

98. Which of the following is the result of varying magnification of rays refracted through different zones of the lens ?

(1) Coma

(2) Astigmatism

(3) Hypermetropia

(4) Myopia

99. In the construction of Fresnel's biprism two acute angled prisms are placed to base. Actually, it is constructed as a single prism of obtuse angle of about :

(1) 180°
(2) 179°
(3) 178°
(4) 177°

100. If the central fringe is displaced to the position, which was occupied by lst bright fringe on placing a thin mica sheet of thickness 1.2 μm in the path of one of the interfering beams in a biprism arrangement, then the refractive index of mica sheet will be (wavelength of light used is 6000 Å) :

(1) 1.4
(2) 1.5
(3) 1.6
(4) 1.7

Total No. of Printed Pages : 21

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D

SET-Y

PG-EE-July, 2024

SUBJECT : Physics

10056

Sr. No. .....

Time : **1¼ Hours** Max. Marks : **100** Total Questions : **100**

Roll No. (in figures)_____ (in words) _____

Name _____ Date of Birth_____

Father's Name _____ Mother's Name_____

Date of Examination _____

_____ _____

(Signature of the Candidate) (Signature of the Invigilator)

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2. The candidates ***must return*** the question booklet as well as OMR Answer-Sheet to the Invigilator concerned before leaving the Examination Hall, failing which a case of use of unfair-means / mis-behaviour will be registered against him / her, in addition to lodging of an FIR with the police. Further the answer-sheet of such a candidate will not be evaluated.
3. Keeping in view the transparency of the examination system, carbonless OMR Sheet is provided to the candidate so that a copy of OMR Sheet may be kept by the candidate.
4. Question Booklet along with answer key of all the A, B, C & D code shall be got uploaded on the University Website immediately after the conduct of Entrance Examination. Candidates may raise valid objection/complaint if any, with regard to discrepancy in the question booklet/answer key within 24 hours of uploading the same on the University Website. The complaint be sent by the students to the Controller of Examinations by hand or through email. Thereafter, no complaint in any case, will be considered.
5. The candidate ***must not*** do any rough work or writing in the OMR Answer-Sheet. Rough work, if any, may be done in the question booklet itself. Answers ***must not*** be ticked in the question booklet.
6. ***There will be no negative marking. Each correct answer will be awarded one full mark. Cutting, erasing, overwriting and more than one answer in OMR Answer-Sheet will be treated as incorrect answer.***
7. Use only **Black** or **Blue Ball Point Pen** of good quality in the OMR Answer-Sheet.
8. *Before answering the questions, the candidates should ensure that they have been supplied correct and complete booklet. Complaints, if any, regarding misprinting etc. will not be entertained* **30** *minutes after starting of the examination.*

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(2) $\frac{1}{2}(m_1+m_2)\,\dot{x}^2+\frac{1}{2}(m_1-m_2)\,gx-V_0$

(3) $(m_1+m_2)\,\dot{x}^2+(m_1-m_2)\,gx-V_0$

(4) $\frac{1}{2}(m_1+m_2)\,\dot{x}^2+(m_1+m_2)\,gx-V_0$

20. A cylinder of mass M and radius R is rolling down without sleeping on an inclined plane of angle of inclination θ. The number of generalized coordinate required to describe the motion of the system :

(1) 1 (2) 2

(3) 4 (4) 6

21. Voltage gain is highest in :

(1) Common base amplifier

(2) Common collector amplifier

(3) Common emitter amplifier

(4) A Diode in forward bias

22. In a common base amplifier, if the emitter current is 2 mA and current gain is 0.99. then base current is :

(1) 1.98 mA (2) 2.02 mA

(3) 0.02 mA (4) 0.2 mA

23. Which of the following is used for rectifying action ?

(1) Transistor

(2) Diode

(3) Capacitor

(4) Inductor

24. Which of the following is ***true*** in case of a PN junction diode ?

(1) In forward bias the current flows due to majority charge careers

(2) The width of the depletion region decreases in reverse bias

(3) The avalanche breakdown takes place in forward bias

(4) None of the above

25. Charge on a p-type semiconductor is :

(1) Positive

(2) Negative

(3) Zero

(4) 10^{-12} coulomb

26. The effective mass of an electron in a semiconductor :

(1) can never be negative

(2) can never be positive

(3) can be positive or negative

(4) depends on its spin

27. An ac generator produces an EMF of amplitude 22 V at a frequency 50 Hz, it is connected to a circuit containing 10 mH inductor. The current in the circuit is :

(1) $22 \sin\left(100\pi t + \frac{\pi}{2}\right)$

(2) $22 \sin\left(100\pi t - \frac{\pi}{2}\right)$

(3) $7 \sin\left(100\pi t + \frac{\pi}{2}\right)$

(4) $7 \sin\left(100\pi t - \frac{\pi}{2}\right)$

28. A Space ship is approaching a source of light with a speed equal to 0.5c (c is speed of light). Light coming from the source of light as seen by the observer in the space ship travels with a speed equal to :

(1) 0.5c

(2) c

(3) 1.5c

(4) 2c

29. The temperature at which the average speed of H_2 molecules will be same as that of N2 molecules at 35°C will be :

(1) 2.5°C

(2) 6.25°C

(3) –50°C

(4) –251°C

30. The elastic fatigue distinctly illustrated in :

(1) Iron (2) Silver

(3) Quartz (4) Glass

31. The particles describe by antisymmetric wave functions are known as :

(1) Photons (2) Fermions

(3) Bosons (4) Gravitons

32. In case of Fermi-Dirac statistics, all particles cannot come down to the ground state due to :

(1) Pauli's exclusion principle

(2) Heisenberg uncertainty principal

(3) Gibb's free energy principle

(4) Plank's law

33. If Two stars X and Y emit light of orange and yellow colours, respectively, then the temperature will be greater for

(1) X

(2) Y

(3) Both have same temperature

(4) Can't say anything

34. Six distinguishable particles are distributed in two compartments with equal a priori probability. Then the probability of the most probable microstate is :

(1) $\frac{15}{32}$ (2) $\frac{15}{64}$

(3) $\frac{5}{16}$ (4) $\frac{5}{32}$

35. The Fourier transform, $F(k)$ of the function $f(x) = e^{-|x|}$ is :

(1) $\frac{1}{1+ik}$

(2) $\frac{1}{1-ik}$

(3) $\frac{2}{1+k^2}$

(4) $\frac{1}{1+k^2}$

36. If two lenses of focal lengths 9 cm and 3 cm are placed at a certain distance apart to form an achromatic combination, then the distance between the lenses is :

(1) 2.25 cm

(2) 4.50 cm

(3) 6 cm

(4) 12 cm

37. The aberrations produced by the variation of refractive index with wavelength of light are called :

(1) Spherical aberrations

(2) chromatic aberrations

(3) astigmatism

(4) none of the above

38. Which of the following is the result of varying magnification of rays refracted through different zones of the lens ?

(1) Coma

(2) Astigmatism

(3) Hypermetropia

(4) Myopia

39. In the construction of Fresnel's biprism two acute angled prisms are placed to base. Actually, it is constructed as a single prism of obtuse angle of about :

(1) 180°

(2) 179°

(3) 178°

(4) 177°

40. If the central fringe is displaced to the position, which was occupied by Ist bright fringe on placing a thin mica sheet of thickness 1.2 μm in the path of one of the interfering beams in a biprism arrangement, then the refractive index of mica sheet will be (wavelength of light used is 6000 Å) :

(1) 1.4 (2) 1.5

(3) 1.6 (4) 1.7

41. What should be the velocity of an electron so that its linear momentum becomes equal to that of a photon of wavelength 10 Å ?

(1) 3×10^8 ms $^{-1}$ (2) $3 \times 10^7 ms^{-1}$

(3) $7.27 \times 10^6 ms^{-1}$ (4) $7.27 \times 10^5 ms^{-1}$

42. An electron is accelerated from rest through a potential difference of 200 v. If e/m for electron is 1.6×10^{11} C/Kg, the speed acquired by the electron will be :

(1) 8×10^6 ms $^{-1}$

(2) 8×10^5 ms $^{-1}$

(3) $5.656 \times 10^6 ms^{-1}$

(4) $5.656 \times 10^5 ms^{-1}$

43. According to Debye theory, the specific heat of solids at low temperature is proportional to :

(1) T^0 (2) T

(3) T^2 (4) T^3

44. Which of the following is not correct with regard to Debye approximation ?

(1) Debye theory obeys Doulong and Petit's law at high temperatures.

(2) The quantum considerations carry great significance at high temperatures.

(3) At low temperatures the phonons obey same statistics as that obeyed by photons at all temperatures.

(4) The specific heat of solids is proportional to T^3 at low temperatures.

45. How many space Lattices can be obtained from the different crystal systems ?

(1) 8 (2) 14

(3) 32 (4) 230

46. How many unit cells are present in a cube - shaped ideal crystal of NaCl of mass 1g ? [Atomic mass of Na and Cl are 23 and 35.5, respectively]

(1) 1.03×10^{22} (2) 5.14×10^{21}

(3) 2.57×10^{21} (4) 1.03×10^{21}

47. The number of carbon atoms per unit cell of diamond unit cell is :

(1) 1 (2) 4

(3) 6 (4) 8

48. The number of close neighbour in a body centered cubic lattice of identical sphere is :

(1) 2 (2) 4

(3) 6 (4) 8

49. In face centered cubic unit cell, the edge length is :

(1) $\frac{4}{\sqrt{2}}r$ (2) $\frac{\sqrt{3}}{2}r$

(3) $\frac{4}{3}r$ (4) $2r$

50. The ratio of density of lattice points in (110) and (111) planes in a simple cubic lattice is :

(1) 1 : 1 (2) 1 : 2

(3) $\sqrt{3} : \sqrt{2}$ (4) $\sqrt{2} : \sqrt{3}$

51. The energy of the lowest state in one dimensional box of length a is :

(1) Zero (2) $\frac{h}{4ma^2}$

(3) $\frac{h}{8ma^2}$ (4) $\frac{h^2}{8ma^2}$

52. The wavefunction of a particle is given by :

$\psi = Ae^{-kx}$ for $0 < x < \infty$
$= 0$ for $-\infty < x < 0$

The value of Λ is :

(1) $\sqrt{\frac{k}{2}}$ (2) $\sqrt{k}$

(3) $\sqrt{\frac{2}{k}}$ (4) $\sqrt{\frac{1}{k}}$

53. In one dimensional potential box of length a, the probability of finding a particle will be maximum at :

(1) Zero (2) $\frac{a}{4}$

(3) $\frac{a}{2}$ (4) a

54. According to Schrödinger, a particle is equivalent to :

(1) A sound wave
(2) A wave packet
(3) A light wave
(4) A single wave

55. An eigenfunction of an operator $\frac{d^2}{dx^2}$ is e^{ax}. The corresponding eigenvalue will be :

(1) 1 (2) $\alpha^{0.5}$

(3) α (4) α^2

56. If an electron, a proton, and a neutron have same de-Broglie wavelength, then which particle has greater velocity ?

(1) Election
(2) Proton
(3) Neutron
(4) All have same velocity

57. If an α-particle and a proton have same kinetic energy, then the ratio wavelengths of the α- particle and the proton will be

(1) 1 : 2 (2) 1 : 4

(3) 2 : 1 (4) 4 : 1

58. The linear momentum of a photon with weavelength λ will be :

(1) Zero (2) $\frac{h}{\lambda}$

(3) $\frac{h}{\lambda^2}$ (4) $\frac{h}{c\lambda}$

59. The threshold wavelength of sodium metal is 6800 Å. The work function of sodium metal is :

(1) 0.91 eV (2) 1.82eV

(3) 2.27eV (4) 3.64eV

60. If the uncertainty in the position of an electron is 1 Å, then the value of uncertainty in its momentum will be :

(1) $6.6 \times 10^{-34} Kgms^{-1}$ (2) $2.2 \times 10^{-34} Kgms^{-1}$

(3) $3.33 \times 10^{-24} Kgms^{-1}$ (4) $1.03 \times 10^{-24} Kgms^{-1}$

61. The set of Miller Indices for a plane which cuts off intercepts in the ratio 2a:4b:1c is :

(1) (214) (2) (241)

(3) (124) (4) (142)

62. If a plane makes intersects of 2, 1 and 0.5 Å on the crystallographic axes of an orthorhombic crystal with a:b:c = 3:2:1, then the Miller indices of this plane are :

(1) (421) (2) (344)

(3) (433) (4) (321)

63. Which of the following has the least packing fraction ?

(1) Simple cubic structure

(2) Body centered cubic structure

(3) Face centered cubic structure

(4) Diamond structure

64. The volume of the primitive unit cell of *fcc* structure with a lattice constant a is :

(1) $\frac{a^3}{8}$ (2) $\frac{a^3}{4}$

(3) $\frac{a^3}{2}$ (4) a^3

65. Which of the following is ***not*** true regarding wavelength of X-rays used in X-ray diffraction method ?

(1) When the wavelength of the X-rays is much smaller than the interplanar spacing then the X-rays are diffracted through angles which are too smart to be measured experimentally.

(2) X-rays having wavelength equal to the interplanar spacing are appropriate for X-ray diffraction

(3) X-rays having wavelength just greater than twice the interplanar spacing are most appropriate for x-ray diffraction

(4) Both (1) &(2).

66. The wavelength corresponding to the maximum intensity emitted by a body is :

(1) directly proportional to the temperature of the body

(2) inversely proportional to the temperature of the body

(3) directly proportional to the 4th power of the temperature of the body

(4) inversely proportional to the 4th power of the temperature of the body

67. The phenomenon known as Bose-Einstein condensation was invoked by F. London to explain :

(1) the free electron theory

(2) superfluidity exhibited by liquid ^3He

(3) the Planck's radiation law

(4) London equation

68. Which of the following statistics is classical statistics ?

(1) Maxwell-Boltzmann statistics

(2) Bose-Einstein statistics

(3) Fermi-Dirac statistics

(4) Both (1) and (3)

69. The minimum volume of phase space cell in Fermi-Dirac statistics is equal to :

(1) h^3 (2) h^3

(3) zero (4) $\frac{h^3}{c}$

70. Stefan's constant depends upon :

(1) Energy radiated per unit area per second

(2) Temperature of the black body

(3) Both (1)&(2)

(4) Does not depend upon (1)&(2)

71. According to Lloyd's single mirror experiment, a light wave after reflection from an optically denser medium undergoes a phase change of :

(1) $\frac{\pi}{2}$ (2) π

(3) $\frac{3\pi}{2}$ (4) 2π

72. The ratio of adiabatic to isochoric pressure coefficient of expansion of a gas is $\left(\gamma = \frac{C_p}{C_v}\right)$:

(1) γ

(2) $\frac{\gamma}{\gamma+1}$

(3) $\frac{\gamma}{\gamma-1}$

(4) $\frac{1}{\gamma}$

73. Which of the following is called first latent heat equation ? (where symbols have usual meaning)

(1) $\frac{dP}{dT} = \frac{L}{T(V_2 - V_1)}$

(2) $\frac{dP}{dT} = \frac{LT}{(V_2 - V_1)}$

(3) $\frac{dP}{dT} = \frac{L(V_2 - V_1)}{T}$

(4) $\frac{dP}{dT} = \frac{T(V_2 - V_1)}{L}$

74. Which of the following is ***not*** a thermodynamical potential ?

(1) Internal energy

(2) Entropy

(3) Enthalpy

(4) Helmholtz free energy

75. One mole of an ideal gas at an initial temperature of T Kelvin does 6R Joule of work adiabatically. If the ratio specific heats of this gas at constant pressure and at constant volume is 5/3, the final temperature of the gas will be :

(1) (T+4) K

(2) (T-4) K

(3) (T+10) K

(4) (T–10) K

76. When a gas passes through a porous plan heating effect takes place :
(1) If temperature of the gas is less than its temperature of inversion
(2) If temperature of the gas is equal to its temperature of inversion
(3) If temperature of gas is more than its temperature of inversion
(4) None of the above

77. Which of the following is scientific language of computer ?
(1) PASCAL
(2) FORTRAN
(3) BASIC
(4) COBOL

78. During an adiabatic reversible process, the entropy :
(1) increases
(2) decreases
(3) first increases then decreases
(4) remains constant

79. What is the efficiency of a Carnot's engine working between the steam point and t ice point ?
(1) 26.81 %
(2) 33.29%
(3) 43.47%
(4) 100%

80. An oscillator consists :
(a) of a positive feedback amplifier
(b) has noise as the initial signal
(c) consists of a noise selecting network
(d) consists of a noise injecting network
Which of the above statements are ***correct*** ?
(1) a & d
(2) b & d
(3) a, b & c
(4) b, c & d

81. The width of the plateau region in a GM counter depends upon :
(1) Type of radiation
(2) Energy of radiation
(3) Both (1) and (2)
(4) None of the above

82. Which of the following is a better material for shielding of Beta radiations ?
(1) Aluminum
(2) Lead
(3) Platinum
(4) Bismuth

83. The reaction time for a direct nuclear reaction is of the order of :
(1) 10^{-10} second
(2) 10^{-15} second
(3) 10^{-20} second
(4) 10^{-30} second

84. Which of the following is not true about Alpha emission ?
(1) The atomic number of parent nucleus decreased by 2 after Alpha mission.
(2) The mass number of parent nucleus decreased by 4 after Alpha mission.
(3) The Alpha emission spectrum is a continuous spectrum.
(4) The most energetic Alpha particles are emitted from Polonium-212.

85. The energy of a thermal neutron at 27°C is :
(1) 0.026eV
(2) 0.26eV
(3) 2.6eV
(4) 26eV

86. The density of the nucleus is of the order of :

(1) 10^{12}Kgm^{-3} (2) 10^{17}Kgm^{-3}

(3) 10^{22} Kgm^{-3} (4) 10^{27} Kgm^{-3}

87. Beta decay is a consequence of :

(1) strong nuclear force

(2) electromagnetic force

(3) weak nuclear force

(4) gravitational force

88. The number of electron-ion pairs created by a Gamma radiation of energy 1 MeV in gas having ionization potential equal to 25 V is :

(1) 6.4×10^6 (2) 6.4×10^4

(3) 4×10^6 (4) 4×10^4

89. The minimum energy of photon required for pair production is :

(1) 1.022 eV

(2) 1.022 KeV

(3) 1.022 MeV

(4) 511 KeV

90. In terms of Redburg's constant (R), the wave number of first Balmer line is :

(1) R

(2) 3R/4

(3) 5R/36

(4) 8R/9

91. The Young's modulus of a wire of length L and radius R is Y. If the length is reduced to L/2 and radius to R/ 2, it's Young's modulus will be :.

(1) Y/2 (2) Y

(3) 2Y (4) 4Y

92. Practical value of Poisson's ratio (σ) can be :

(1) Less than zero

(2) Between 0 and 0.5

(3) Between -1 and 0.5

(4) Greater than 0.5

93. The potential energy per unit volume for a body strained under a longitudinal strain shall be equal to :

(1) stress × strain

(2) stress × $(\text{strain})^2$

(3) 1/2 stress × $(\text{strain})^2$

(4) 1/2(stress × strain)

94. The Boltzmann's constant depends on :

(1) Temperature

(2) Volume and Temperature

(3) Pressure, volume and Temperature

(4) None of the above

95. The pressure exerted on the walls of the container by a gas is due to the fact that the gas molecules :

(1) lose their kinetic energy

(2) stick to the walls

(3) are accelerated towards the walls

(4) change their momenta due to collision with the walls

96. If a moving charge particle passes through region having random magnetic field, then the kinetic energy of the charge particle will :

(1) Increase

(2) Decrease

(3) Remain same

(4) Increase or decrease depending upon the nature of charge particle

97. If two long current carrying conductors are placed parallel to each other in free spac and current is passing through both the conductors in same directions, then the forc between them will be :

(1) Attractive
(2) Repulsive
(3) No force
(4) Can't say anything

98. The area of hysteresis loop for a ferromagnetic material represents :

(1) The square of magnetism per cycle
(2) Energy loss per cycle
(3) Coercivity
(4) Retentivity

99. The concept of displacement current was proposed by :

(1) Faraday
(2) Ampere
(3) Biot-Savart
(4) Maxwell

100. A charged capacitor (C) is connected in series with an inductor (L). When th displacement current reduces to zero, the energy of the LC circuit is :

(1) stored entirely in its magnetic field
(2) stored entirely in its electric field
(3) distributed equally among its electric and magnetic fields
(4) radiated out of the circuit

Answer keys of M.Sc.(Physics) entrance exam dated 15.07.2024				
Q. NO.	A	B	C	D
1	4	3	1	3
2	1	3	2	3
3	3	2	4	2
4	3	1	2	2
5	1	3	3	2
6	2	3	2	4
7	3	4	2	2
8	4	2	1	1
9	3	4	2	1
10	3	4	4	2
11	3	2	3	1
12	3	1	3	3
13	2	2	3	4
14	2	3	2	2
15	2	3	4	4
16	4	3	1	3
17	2	2	1	4
18	1	1	2	3
19	1	2	2	1
20	2	2	4	2
21	3	4	4	3
22	3	1	1	3
23	3	4	3	2
24	2	2	3	1
25	4	2	1	3
26	1	3	2	3
27	1	4	3	4
28	2	4	4	2
29	2	1	3	4
30	4	3	3	4
31	4	3	1	2
32	1	3	3	1
33	4	2	4	2
34	2	2	2	3
35	2	2	4	3
36	3	4	3	3
37	4	2	4	2
38	4	1	3	1
39	1	1	1	2
40	3	2	2	2
41	1	1	2	4
42	2	3	3	1
43	4	4	1	4
44	2	2	2	2
45	3	4	2	2
46	2	3	3	3
47	2	4	2	4
48	1	3	4	4
49	2	1	1	1
50	4	2	1	3

15/7/24 15/07/2024 15/07/2024 15/07/24

Answer keys of M.Sc.(Physics) entrance exam dated 15.07.2024				
Q. NO.	A	B	C	D
51	2	2	4	3
52	1	3	1	3
53	2	1	4	3
54	3	2	2	2
55	3	2	2	4
56	3	3	3	1
57	2	2	4	1
58	1	4	4	2
59	2	1	1	2
60	2	1	3	4
61	2	2	3	1
62	3	2	3	2
63	1	4	2	4
64	2	4	1	2
65	2	4	3	3
66	3	3	3	2
67	2	1	4	2
68	4	2	2	1
69	1	4	4	2
70	1	1	4	4
71	3	1	2	2
72	3	2	2	3
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89	4	2	1	3
90	1	4	2	3
91	1	4	2	2
92	3	1	1	2
93	4	3	2	4
94	2	3	3	4
95	4	1	3	4
96	3	2	3	3
97	4	3	2	1
98	3	4	1	2
99	1	3	2	4
100	2	3	2	1

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