

(DO NOT OPEN THIS QUESTION BOOKLET BEFORE TIME OR UNTIL YOU  
ARE ASKED TO DO SO)

**A**

**SET-X**

**PG-EE-June, 2023**

**SUBJECT : Physics**

**10457**

Sr. No. ....

Total Questions : 100

Time : 1¼ Hours

Max. Marks : 100

Roll No. (in figures) \_\_\_\_\_ (in words) \_\_\_\_\_

Name \_\_\_\_\_ Date of Birth \_\_\_\_\_

Father's Name \_\_\_\_\_ Mother's Name \_\_\_\_\_

Date of Examination \_\_\_\_\_

\_\_\_\_\_  
(Signature of the Candidate) \_\_\_\_\_  
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PG-EE-June, 2023/(Physics)(SET-X)/(A)

SEAL

1. The volume element in spherical polar co-ordinates is :
 

(1) $r dr \sin \theta d\theta d\phi$	(2) $r^2 dr \sin \theta d\theta d\phi$
(3) $r^2 dr \sin \theta d\theta$	(4) $r^3 dr \sin \theta d\theta d\phi$
  
2. Total kinetic energy of circular disc rolling on a table is :
 

(1) $\frac{3}{4} Mr^2 w^2$	(2) $\frac{1}{2} Mr^2 w^2$
(3) $\frac{3}{4} M^2 r^2 w^2$	(4) $\frac{1}{2} M^2 r^2 w^2$
  
3. An inclined plane makes an angle of  $30^\circ$  with the horizontal. A solid sphere rolling down the inclined plane from rest without slipping has a linear acceleration given by :
 

(1) $g/3$	(2) $2g/3$	(3) $5g/3$	(4) $5g/14$
-----------	------------	------------	-------------
  
4. The number of degrees of freedom of the particle moving on the circumference of a circle is :
 

(1) 1	(2) 2	(3) 3	(4) 6
-------	-------	-------	-------
  
5. The constraint on a particle moving on an ellipsoid under the influence of gravity is :
 

(1) Holonomic	(2) Nonholonomic
(3) rheonomic	(4) both holonomic and rheonomic
  
6. The homogeneity of time leads to the law of conservation of :
 

(1) Linear momentum	(2) Angular momentum
(3) Energy	(4) Parity
  
7. Three identical metal balls, each of radius R, are placed touching each other on a horizontal surface such that an equilateral triangle is formed when the centres of the three balls are joined. The centre of mass of the system is located at :
  - (1) Horizontal surface
  - (2) Centre of one of the balls
  - (3) Line joining centres of any two balls
  - (4) Point of intersection of their medians

8. Increase in length of a wire on stretching is 0.025%. If its Poisson's ratio is 0.4, then the percentage increase in diameter is :  
 (1) 0.01                      (2) 0.02                      (3) 0.03                      (4) 0.04
9. A beam of metal supported at the two ends is loaded at the centre. The depression at the centre is proportional to :  
 (1)  $Y^2$                       (2)  $Y$                       (3)  $1/Y$                       (4)  $1/Y^2$
10. The stress required to double the length of a wire of Young's modulus  $Y$  is :  
 (1)  $Y/2$                       (2)  $2Y$                       (3)  $Y$                       (4)  $4Y$
11. The bulk modulus of a rubber is  $9.1 \times 10^8 \text{ N/m}^2$ . To what depth (approximately) a rubber ball be taken in a lake so that its volume is decreased by 0.1% ?  
 (1) 25 m                      (2) 100 m                      (3) 200 m                      (4) 500 m
12. If the masses of all molecules of a gas are halved and their speeds doubled, then the ratio of initial and final pressures would be :  
 (1) 2 : 1                      (2) 1 : 2                      (3) 4 : 1                      (4) 1 : 4
13. The root mean square velocity of the molecules of a gas is 1260 m/s. The most probable speed of the molecules is :  
 (1) 1029 m/s                      (2) 1161 m/s                      (3) 1671 m/s                      (4) 917 m/s
14. Two photons approach each other. Their relative velocity will be :  
 (1) Zero                      (2) Less than  $C$                       (3) More than  $C$                       (4)  $C$
15. The **apparent** length of a meter rod moving parallel to its length with velocity  $0.8C$  will be :  
 (1) 0.5 m                      (2) 0.6 m                      (3) 1 m                      (4) 1.5 m
16. The equation  $\vec{\nabla} \times \vec{E} = -\frac{\partial \vec{B}}{\partial t}$  represents :  
 (1) Gauss's law                      (2) Coulomb's law  
 (3) Ampere's law                      (4) Faraday's law
17. An electromagnetic wave going through vacuum is described by  $E = E_0 \sin(kx - \omega t)$ . Which of the following is independent of wavelength ?  
 (1)  $k$                       (2)  $\omega$                       (3)  $\omega/k$                       (4)  $k\omega$

18. The electric field intensity on the surface of a solid charged sphere of radius  $r$  and volume charge density  $\rho$  is given by :
- (1)  $\rho r / 3 \epsilon_0$       (2)  $\frac{1}{4\pi \epsilon_0} \frac{\rho}{r}$       (3) zero      (4)  $\frac{5\rho r}{6 \epsilon_0}$
19. Liquids and gases never exhibit :
- (1) Diamagnetic properties      (2) Paramagnetic properties  
(3) Ferromagnetic properties      (4) Ferromagnetic properties
20. Electromagnets are made of soft iron because soft iron has :
- (1) Low retentivity and low coercivity  
(2) High retentivity and high coercivity  
(3) Low retentivity and high coercivity  
(4) High retentivity and low coercivity
21. Curie temperature is the temperature above which :
- (1) A paramagnetic material becomes diamagnetic  
(2) A ferromagnetic material becomes diamagnetic  
(3) A paramagnetic material becomes ferromagnetic  
(4) A ferromagnetic material becomes paramagnetic
22. The Poisson's equation in CGS Gaussian system is :
- (1)  $\nabla^2 V = -\frac{\rho}{\epsilon_0}$       (2)  $\nabla^2 V = -4\pi\rho$       (3)  $\nabla^2 V = -4\pi \epsilon_0$       (4)  $\nabla^2 V = 0$
23. An inductance of  $2H$  and resistance of  $10\Omega$  are connected in series to a battery of  $5V$ . The initial rate of change of current is :
- (1)  $2.5 A/s$       (2)  $2.0 A/s$       (3)  $0.5 A/s$       (4)  $0.25 A/s$
24. A solenoid of resistance  $50\Omega$  and inductance  $5mH$  is connected to  $200V$  battery. The maximum energy stored is :
- (1)  $4 mJ$       (2)  $0.4 mJ$       (3)  $40 mJ$       (4)  $400 mJ$
25. In LCR circuit if resistance increases, the quality factor :
- (1) Increases      (2) Decreases  
(3) Remains constant      (4) None of these

26. The phase difference between the voltage and current of LCR circuit in series at resonance is :
- (1)  $\pi$                       (2)  $\pi/2$                       (3) Zero                      (4)  $\pi/4$
27. A P-N junction diode can not be used :
- (1) as a rectifier  
(2) for increasing the amplitude of an AC signal  
(3) for getting light radiation  
(4) for converting light energy into electrical energy
28. The bandwidth and voltage gain of an amplifier using negative feedback :
- (1) Decreases, increases respectively      (2) Decreases, decreases respectively  
(3) Increases, decreases respectively      (4) Increases, increases respectively
29. Emitter follower is an amplifier employing :
- (1) Voltage series feedback                      (2) Current series feedback  
(3) Voltage shunt feedback                      (4) Current shunt feedback
30. The time base of a CRO is developed by :
- (1) Sawtooth waveform                      (2) Square waveform  
(3) Triangular waveform                      (4) Sinusoidal waveform
31. If the temperatures of source and sink of a Carnot engine having efficiency  $\eta$  are each decreased by 100 K, then the efficiency :
- (1) Remains constant                      (2) Decreases  
(3) Increases                      (4) Becomes Zero
32. In a reversible process, the entropy of the universe :
- (1) Decreases                      (2) Increases  
(3) Remains unchanged                      (4) Fluctuates
33. Method which uses a list of well defined instruction to complete a task starting from a given initial state to end state is :
- (1) Program                      (2) Flow chart                      (3) Algorithm                      (4) Both (1) and (2)



42. Chromatic aberration in the formation of images by a lens arises because :
- (1) of non-paraxial rays
  - (2) radii of curvature of two sides are not same
  - (3) of the defects in grinding
  - (4) The focal length varies with wavelength
43. One cannot see through fog because :
- (1) fog absorbs light
  - (2) the refractive index of fog is infinity
  - (3) light suffers total reflection at the droplets in fog
  - (4) light is scattered by droplets in fog
44. A person is suffering from the defect of astigmatism. It's main reason is :
- (1) distance of the eye lens from retina is increased
  - (2) power of accommodation of the eye is decreased
  - (3) the cornea is not spherical
  - (4) the distance of the eye lens from the retina is decreased
45. In a Fresnel biprism experiment, the two positions of lens give separation between the slits as 16 cm and 9 cm respectively. The actual distance of separation of slits is :
- (1) 12.5 cm
  - (2) 12.0 cm
  - (3) 13 cm
  - (4) 14 cm
46. A thin mica sheet of thickness  $2 \times 10^{-6}$  m and refractive index  $\mu = 1.5$  is introduced in the path of one of the waves. The wavelength of the wave used is 5000 Å. The central bright maximum will shift :
- (1) 2 fringes upward
  - (2) 2 fringes downward
  - (3) 10 fringes upward
  - (4) 10 fringes downward
47. A bag contains 5 red balls, 8 white balls and 10 black balls. If a ball is drawn from the bag, the probability that it is either white or black is :
- (1) 5/18
  - (2) 8/18
  - (3) 10/23
  - (4) 18/23
48. Sterling's formula states that for every large value of N,  $\ln N!$  is equal to :
- (1)  $N!$
  - (2)  $N(\ln N - 1)$
  - (3)  $N \ln N$
  - (4)  $\frac{\ln N}{N}$

- 49.** Boltzmann relation between entropy ( $s$ ) and thermodynamic probability ( $W$ ) is :
- (1)  $S = \ln W$       (2)  $S = \frac{\ln W}{k}$       (3)  $S = k \ln W$       (4)  $S = \frac{k}{\ln W}$
- 50.** Maxwell-Boltzmann statistics is applicable for :
- (1) Photon      (2) Ideal gas      (3) Electron      (4) Proton
- 51.** Particles obeying Bose-Einstein statistics have :
- (1) any spin      (2) integral spin      (3) half integral spin      (4) zero spin
- 52.** Planck's law of radiation can be derived by applying :
- (1) Maxwell-Boltzmann Statistics      (2) Bose-Einstein Statistics  
(3) Fermi-Dirac Statistics      (4) None of these
- 53.** The number of co-ordinates in the phase space of a single particle is :
- (1) 2      (2) 3      (3) 5      (4) 6
- 54.** If a shift of 200 fringes is observed when the movable mirror is shifted through 0.0589 mm, the wavelength of light used in Michelson's Interferometer is :
- (1) 5890 Å      (2) 2945 Å      (3) 2006 Å      (4) 1475 Å
- 55.** A wedge shaped film is viewed with light of  $\lambda = 6 \times 10^{-5}$  cm. There are 10 fringes per cm. The angle of wedge is :
- (1)  $1 \times 10^{-4}$  radian      (2)  $2 \times 10^{-4}$  radian      (3)  $3 \times 10^{-4}$  radian      (4)  $4 \times 10^{-4}$  radian
- 56.** Which optical instrument is employed to obtain interference fringes of various shapes ?
- (1) Michelson interferometer      (2) Fabrey-Perot interferometer  
(3) Newton rings      (4) Fresnel's biprism
- 57.** If white light is used in the Newton's rings experiment, the colour observed in the reflected light is complementary to that observed in the transmitted light through the same point. This is due to :
- (1)  $90^\circ$  change of phase in one of the reflected waves  
(2)  $180^\circ$  change of phase in one of the reflected waves  
(3)  $135^\circ$  change of phase in one of the reflected waves  
(4)  $45^\circ$  change of phase in one of the reflected waves





67. The packing factor of diamond cubic crystal structure is :  
(1) 60%                      (2) 56%                      (3) 90%                      (4) 34%
68. If 0.28 nm is the interionic distance in NaCl crystal, the lattice parameter is :  
(1) 0.14 nm                      (2) 0.56 nm                      (3) 0.08 nm                      (4) 0.41 nm
69. If the angle between the direction of the incident X-ray and the diffracted ray is  $16^\circ$ , the angle of incidence will be :  
(1)  $32^\circ$                       (2)  $24^\circ$                       (3)  $90^\circ$                       (4)  $82^\circ$
70. Which of the following statements is in accordance with Einstein's theory of specific heat of solids :  
(1) Specific heat drops linearly with increase of temperature  
(2) Specific heat drops linearly with decrease of temperature  
(3) Specific heat drops exponentially with decrease of temperature  
(4) Specific heat remains constant
71. The number of sulphide atoms in the unit cell of zinc sulphide crystal is :  
(1) 2                      (2) 4                      (3) 3                      (4) 6
72. In Compton effect the transfer of energy becomes the maximum when the angle of scattering of the photon is :  
(1)  $90^\circ$                       (2)  $180^\circ$                       (3)  $60^\circ$                       (4)  $30^\circ$
73. Davisson-Germer experiment is related to the phenomenon of :  
(1) Interference                      (2) Diffraction  
(3) Reflection                      (4) Polarization
74. The correct relation between group velocity ( $v_g$ ) and phase velocity ( $v_p$ ) is :  
(1)  $v_g = v_p - \lambda \frac{dv_p}{d\lambda}$                       (2)  $v_g = v_p + \lambda \frac{dv_p}{d\lambda}$   
(3)  $v_g = v_p - \lambda \frac{dv_g}{d\lambda}$                       (4)  $v_p = v_g - \frac{1}{\lambda} \frac{dv_g}{d\lambda}$

75. The uncertainty principle tells us that :
- (1) A particle can have only position but no momentum.
  - (2) A particle can have only momentum but no position.
  - (3) One can determine simultaneously the position and momentum of a particle.
  - (4) One cannot determine simultaneously the position and momentum of a particle.
76. In three dimensions the momentum operator  $\hat{p}$  is :
- (1)  $\hat{p} = -\frac{\hbar}{i} \nabla$
  - (2)  $\hat{p} = -\frac{i\hbar}{\nabla}$
  - (3)  $\hat{p} = \frac{\hbar}{i} \nabla$
  - (4)  $\hat{p} = \frac{\hbar}{i} \nabla$
77. The value of  $\left[ \hat{x}, \frac{\hat{d}}{dx} \right]$  is :
- (1) 0
  - (2) 1
  - (3) -1
  - (4)  $\infty$
78. The energy of a particle in the  $n$ th quantum state in a one-dimensional closed box is proportional to :
- (1)  $n$
  - (2)  $n^2$
  - (3)  $\frac{1}{n}$
  - (4)  $\frac{1}{n^2}$
79. The ground state energy of the one-dimensional oscillator is :
- (1)  $\hbar\omega$
  - (2)  $\frac{1}{2} \hbar\omega$
  - (3)  $\frac{3}{2} \hbar\omega$
  - (4)  $\infty$
80. In case of a potential step of height  $V_0$ , for a particle of energy  $E < V_0$ , the transmittance is :
- (1) Zero
  - (2) Finite non-zero
  - (3) Infinite
  - (4) 1
81. The eigen value associated with an Hermitian operator is :
- (1) Imaginary
  - (2) Complex
  - (3) Real
  - (4) None of these
82. The doublets observed in alkali spectra are due to :
- (1) Screening of the K electron
  - (2) Spin-orbit interaction of the electron
  - (3) Pressure of isotopes
  - (4) Pressure of isotones
83. The value of Lande g factor for the doublet term  ${}^2D_{3/2}$  is :
- (1)  $2/5$
  - (2)  $3/5$
  - (3)  $4/5$
  - (4)  $6/5$

84. The splitting of single line singlet into three component lines in the presence of magnetic field is known as :
- (1) Paschen-Back effect (2) normal Zeeman effect  
(3) Anomalous Zeeman effect (4) Stark effect
85. For a diatomic molecule, Raman lines are observed due to appreciable change in :
- (1) Pressure (2) Shape (3) Polarizability (4) Solubility
86. Rotational constant (B) is related to moment of inertia (I) through the relation :
- (1)  $B = h/8\pi^2 IC$  (2)  $B = 2h/8\pi^2 I^2 C^2$   
(3)  $B = 3h/\pi^2 IC$  (4)  $B = hIC/8\pi^2$
87. The exciting line in an experiment is 5460 Å and the Stoke's line is at 5520 Å. The wavelength of anti-Stoke's line is :
- (1) 5200 Å (2) 4200 Å (3) 5401 Å (4) 5308 Å
88. In the first order Stark effect in hydrogen atom, the ground state :
- (1) Splits in two levels (2) Splits in three levels  
(3) Splits in four levels (4) Does not split
89. In He-Ne laser the population inversion is achieved by :
- (1) Chemical excitation (2) Photon excitation  
(3) Inelastic atomic collisions (4) Thermal excitation
90. Ratio of probabilities of spontaneous emission and stimulated emission is :
- (1) Proportional to frequency ( $\nu$ ) (2) Independent of frequency ( $\nu$ )  
(3) Proportional to  $\nu^2$  (4) Proportional to  $\nu^3$
91. In a Ruby laser, the rod is surrounded by a helical photographic flash lamp filled with :
- (1) Chromium (2) Aluminium (3) Xenon (4) Neon
92. Half-life of a radioactive substance A is two times the half-life of another radioactive substance B. Initially the number of nuclei of A and B are  $N_A$  and  $N_B$  respectively. After three half-lives of A, number of nuclei of both are equal. Then the ratio  $N_A/N_B$  is :
- (1) 1/4 (2) 1/8 (3) 1/3 (4) 1/6

93. Radio carbon dating is done by estimating in specimen the :
- (1) Amount of ordinary carbon still present
  - (2) Amount of radio carbon still present
  - (3) Ratio of amount of  ${}_6C^{14}$  to  ${}_6C^{12}$  still present
  - (4) Ratio of amount of  ${}_6C^{12}$  to  ${}_6C^{13}$  still present
94. The electron emitted in beta radiation originates from :
- (1) Inner orbit of atoms
  - (2) Free electrons exciting in nuclei
  - (3) Decay of a neutron in a nucleus
  - (4) Photon escaping from the nucleus
95. Which of the following is **true** for a Neutrino ?
- (1) It is charged and has spin
  - (2) It is charged and has no spin
  - (3) It is chargeless and has spin
  - (4) It is chargeless and has no spin
96. The operation of a nuclear reactor is said to be critical, if the multiplication factor (K) has a value :
- (1) 1
  - (2) 1.5
  - (3) 2.1
  - (4) 2.5
97. The instrument which is suitable for absolute measurement of the activity of a  $\beta$ -active source is :
- (1) G. M. Counter
  - (2) Scintillation Counter
  - (3) Proportional Counter
  - (4) Ionization Counter
98. Primary cosmic rays are composed of very energetic :
- (1) Electrons
  - (2) Mesons
  - (3) Protons
  - (4) Neutrons
99. Nuclear fusion reaction occurs at temperatures of the order of :
- (1)  $10^3 K$
  - (2)  $10^7 K$
  - (3)  $10^2 K$
  - (4)  $10^4 K$
100. The radius of a nucleus with atomic mass number 7 is 2 Fermi. The radius of nucleus with atomic mass number 189 is :
- (1) 3 Fermi
  - (2) 4 Fermi
  - (3) 5 Fermi
  - (4) 6 Fermi

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B

1. The number of sulphide atoms in the unit cell of zinc sulphide crystal is :
  - (1) 2
  - (2) 4
  - (3) 3
  - (4) 6
2. In Compton effect the transfer of energy becomes the maximum when the angle of scattering of the photon is :
  - (1)  $90^\circ$
  - (2)  $180^\circ$
  - (3)  $60^\circ$
  - (4)  $30^\circ$
3. Davisson-Germer experiment is related to the phenomenon of :
  - (1) Interference
  - (2) Diffraction
  - (3) Reflection
  - (4) Polarization
4. The correct relation between group velocity ( $v_g$ ) and phase velocity ( $v_p$ ) is :
  - (1)  $v_g = v_p - \lambda \frac{dv_p}{d\lambda}$
  - (2)  $v_g = v_p + \lambda \frac{dv_p}{d\lambda}$
  - (3)  $v_g = v_p - \lambda \frac{dv_g}{d\lambda}$
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5. The uncertainty principle tells us that :
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  - (2) A particle can have only momentum but no position.
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- (1)  $\hbar\omega$                       (2)  $\frac{1}{2}\hbar\omega$                       (3)  $\frac{3}{2}\hbar\omega$                       (4)  $\infty$
10. In case of a potential step of height  $V_0$ , for a particle of energy  $E < V_0$ , the transmittance is :
- (1) Zero                      (2) Finite non-zero                      (3) Infinite                      (4) 1
11. Particles obeying Bose-Einstein statistics have :
- (1) any spin                      (2) integral spin                      (3) half integral spin                      (4) zero spin
12. Planck's law of radiation can be derived by applying :
- (1) Maxwell-Boltzmann Statistics                      (2) Bose-Einstein Statistics  
(3) Fermi-Dirac Statistics                      (4) None of these
13. The number of co-ordinates in the phase space of a single particle is :
- (1) 2                      (2) 3                      (3) 5                      (4) 6
14. If a shift of 200 fringes is observed when the movable mirror is shifted through 0.0589 mm, the wavelength of light used in Michelson's Interferometer is :
- (1) 5890 Å                      (2) 2945 Å                      (3) 2006 Å                      (4) 1475 Å
15. A wedge shaped film is viewed with light of  $\lambda = 6 \times 10^{-5}$  cm. There are 10 fringes per cm. The angle of wedge is :
- (1)  $1 \times 10^{-4}$  radian                      (2)  $2 \times 10^{-4}$  radian                      (3)  $3 \times 10^{-4}$  radian                      (4)  $4 \times 10^{-4}$  radian
16. Which optical instrument is employed to obtain interference fringes of various shapes ?
- (1) Michelson interferometer                      (2) Fabry-Perot interferometer  
(3) Newton rings                      (4) Fresnel's biprism
17. If white light is used in the Newton's rings experiment, the colour observed in the reflected light is complementary to that observed in the transmitted light through the same point. This is due to :
- (1)  $90^\circ$  change of phase in one of the reflected waves  
(2)  $180^\circ$  change of phase in one of the reflected waves  
(3)  $135^\circ$  change of phase in one of the reflected waves  
(4)  $45^\circ$  change of phase in one of the reflected waves





25. For an isolated thermodynamical system  $P$ ,  $V$ ,  $T$ ,  $U$  and  $S$  represent the pressure, volume, temperature, internal energy and entropy respectively then the Gibb's potential ( $G$ ) is defined as :
- (1)  $G = U - PV + TS$  (2)  $G = U + PV + TS$   
 (3)  $G = U - PV - TS$  (4)  $G = U + PV - TS$
26. A fluid at high pressure is throttled through a narrow porous opening in a region of lower pressure without any transfer of heat. In such a process :
- (1) The entropy does not change (2) The Gibb's free energy remains constant  
 (3) The entropy is decreased (4) The enthalpy of the fluid is constant
27. Which of the following is *not* Maxwell's equation ?
- (1)  $\left(\frac{\partial S}{\partial V}\right)_T = \left(\frac{\partial P}{\partial T}\right)_V$  (2)  $\left(\frac{\partial T}{\partial V}\right)_S = -\left(\frac{\partial P}{\partial S}\right)_V$   
 (3)  $\left(\frac{\partial V}{\partial P}\right)_S = \left(\frac{\partial T}{\partial S}\right)_V$  (4)  $\left(\frac{\partial T}{\partial P}\right)_S = \left(\frac{\partial V}{\partial S}\right)_P$
28. The combined form of first and second law of thermodynamics is given by :
- (1)  $TdS = dU + PdV$  (2)  $dQ = TdS + PdV$   
 (3)  $dU = TdS + dQ$  (4)  $TdS = dU + PdV$
29. To a fish under water, viewing obliquely a fisherman standing on the bank of a lake, the man looks :
- (1) Taller than what he actually is (2) Shorter than what he actually is  
 (3) The same height as he actually is (4) depends on obliquity
30. Critical angle of light passing from glass to air is minimum for :
- (1) red (2) green (3) yellow (4) violet
31. The bulk modulus of a rubber is  $9.1 \times 10^8 \text{ N/m}^2$ . To what depth (approximately) a rubber ball be taken in a lake so that its volume is decreased by 0.1% ?
- (1) 25 m (2) 100 m (3) 200 m (4) 500 m
32. If the masses of all molecules of a gas are halved and their speeds doubled, then the ratio of initial and final pressures would be :
- (1) 2 : 1 (2) 1 : 2 (3) 4 : 1 (4) 1 : 4

B

33. The root mean square velocity of the molecules of a gas is 1260 m/s. The most probable speed of the molecules is :  
 (1) 1029 m/s      (2) 1161 m/s      (3) 1671 m/s      (4) 917 m/s
34. Two photons approach each other. Their relative velocity will be :  
 (1) Zero      (2) Less than C      (3) More than C      (4) C
35. The *apparent* length of a meter rod moving parallel to its length with velocity  $0.8C$  will be :  
 (1) 0.5 m      (2) 0.6 m      (3) 1 m      (4) 1.5 m
36. The equation  $\vec{\nabla} \times \vec{E} = -\frac{\partial \vec{B}}{\partial t}$  represents :  
 (1) Gauss's law      (2) Coulomb's law  
 (3) Ampere's law      (4) Faraday's law
37. An electromagnetic wave going through vacuum is described by  $E = E_0 \sin(kx - wt)$ . Which of the following is independent of wavelength ?  
 (1)  $k$       (2)  $w$       (3)  $w/k$       (4)  $kw$
38. The electric field intensity on the surface of a solid charged sphere of radius  $r$  and volume charge density  $\rho$  is given by :  
 (1)  $\rho r / 3 \epsilon_0$       (2)  $\frac{1}{4\pi \epsilon_0} \frac{\rho}{r}$       (3) zero      (4)  $\frac{5\rho r}{6 \epsilon_0}$
39. Liquids and gases never exhibit :  
 (1) Diamagnetic properties      (2) Paramagnetic properties  
 (3) Ferromagnetic properties      (4) Ferromagnetic properties
40. Electromagnets are made of soft iron because soft iron has :  
 (1) Low retentivity and low coercivity  
 (2) High retentivity and high coercivity  
 (3) Low retentivity and high coercivity  
 (4) High retentivity and low coercivity
41. In a Ruby laser, the rod is surrounded by a helical photographic flash lamp filled with :  
 (1) Chromium      (2) Aluminium      (3) Xenon      (4) Neon

42. Half-life of a radioactive substance A is two times the half-life of another radioactive substance B. Initially the number of nuclei of A and B are  $N_A$  and  $N_B$  respectively. After three half-lives of A, number of nuclei of both are equal. Then the ratio  $N_A / N_B$  is :
- (1)  $1/4$                       (2)  $1/8$                       (3)  $1/3$                       (4)  $1/6$
43. Radio carbon dating is done by estimating in specimen the :
- (1) Amount of ordinary carbon still present  
(2) Amount of radio carbon still present  
(3) Ratio of amount of  ${}_6C^{14}$  to  ${}_6C^{12}$  still present  
(4) Ratio of amount of  ${}_6C^{12}$  to  ${}_6C^{13}$  still present
44. The electron emitted in beta radiation originates from :
- (1) Inner orbit of atoms                      (2) Free electrons exciting in nuclei  
(3) Decay of a neutron in a nucleus                      (4) Photon escaping from the nucleus
45. Which of the following is *true* for a Neutrino ?
- (1) It is charged and has spin                      (2) It is charged and has no spin  
(3) It is chargeless and has spin                      (4) It is chargeless and has no spin
46. The operation of a nuclear reactor is said to be critical, if the multiplication factor (K) has a value :
- (1) 1                      (2) 1.5                      (3) 2.1                      (4) 2.5
47. The instrument which is suitable for absolute measurement of the activity of a  $\beta$ -active source is :
- (1) G. M. Counter                      (2) Scintillation Counter  
(3) Proportional Counter                      (4) Ionization Counter
48. Primary cosmic rays are composed of very energetic :
- (1) Electrons                      (2) Mesons                      (3) Protons                      (4) Neutrons
49. Nuclear fusion reaction occurs at temperatures of the order of :
- (1)  $10^3 K$                       (2)  $10^7 K$                       (3)  $10^2 K$                       (4)  $10^4 K$

50. The radius of a nucleus with atomic mass number 7 is 2 Fermi. The radius of nucleus with atomic mass number 189 is :
- (1) 3 Fermi            (2) 4 Fermi            (3) 5 Fermi            (4) 6 Fermi
51. What does not change on polarization of light ?
- (1) Intensity            (2) Phase            (3) Frequency            (4) Wavelength
52. The Miller indices of the plane parallel to the  $X$  and  $Y$ -axes are :
- (1) (100)            (2) (010)            (3) (001)            (4) (111)
53. A plane intercepts at  $a$ ,  $b/2$ ,  $3c$  in a simple cubic unit cell. The Miller indices of the plane are :
- (1) (132)            (2) (261)            (3) (361)            (4) (123)
54. The number of lattice points in a primitive cell are :
- (1) 1            (2)  $1/2$             (3) 2            (4)  $3/2$
55. The nearest neighbour distance in the case of bcc structure is :
- (1)  $(a\sqrt{3})/2$             (2)  $(a\sqrt{2})/2$             (3)  $2a/\sqrt{3}$             (4)  $2a/\sqrt{2}$
56. When the potential difference between the electrodes of X-ray tube is increased, there take place an increase in :
- (1) Intensity            (2) Frequency  
(3) Wavelength            (4) Speed of X-rays
57. The packing factor of diamond cubic crystal structure is :
- (1) 60%            (2) 56%            (3) 90%            (4) 34%
58. If 0.28 nm is the interionic distance in NaCl crystal, the lattice parameter is :
- (1) 0.14 nm            (2) 0.56 nm  
(3) 0.08 nm            (4) 0.41 nm
59. If the angle between the direction of the incident X-ray and the diffracted ray is  $16^\circ$ , the angle of incidence will be :
- (1)  $32^\circ$             (2)  $24^\circ$             (3)  $90^\circ$             (4)  $82^\circ$

60. Which of the following statements is in accordance with Einstein's theory of specific heat of solids :
- (1) Specific heat drops linearly with increase of temperature
  - (2) Specific heat drops linearly with decrease of temperature
  - (3) Specific heat drops exponentially with decrease of temperature
  - (4) Specific heat remains constant
61. The eigen value associated with an Hermitian operator is :
- (1) Imaginary
  - (2) Complex
  - (3) Real
  - (4) None of these
62. The doublets observed in alkali spectra are due to :
- (1) Screening of the K electron
  - (2) Spin-orbit interaction of the electron
  - (3) Pressure of isotopes
  - (4) Pressure of isotones
63. The value of Lande g factor for the doublet term  ${}^2D_{3/2}$  is :
- (1)  $2/5$
  - (2)  $3/5$
  - (3)  $4/5$
  - (4)  $6/5$
64. The splitting of single line singlet into three component lines in the presence of magnetic field is known as :
- (1) Paschen-Back effect
  - (2) normal Zeeman effect
  - (3) Anomalous Zeeman effect
  - (4) Stark effect
65. For a diatomic molecule, Raman lines are observed due to appreciable change in :
- (1) Pressure
  - (2) Shape
  - (3) Polarizability
  - (4) Solubility
66. Rotational constant (B) is related to moment of inertia (I) through the relation :
- (1)  $B = h/8\pi^2 IC$
  - (2)  $B = 2h/8\pi^2 I^2 C^2$
  - (3)  $B = 3h/\pi^2 IC$
  - (4)  $B = hIC/8\pi^2$
67. The exciting line in an experiment is  $5460 \text{ \AA}$  and the Stoke's line is at  $5520 \text{ \AA}$ . The wavelength of anti-Stoke's line is :
- (1)  $5200 \text{ \AA}$
  - (2)  $4200 \text{ \AA}$
  - (3)  $5401 \text{ \AA}$
  - (4)  $5308 \text{ \AA}$
68. In the first order Stark effect in hydrogen atom, the ground state :
- (1) Splits in two levels
  - (2) Splits in three levels
  - (3) Splits in four levels
  - (4) Does not split

B

69. In He-Ne laser the population inversion is achieved by :
- (1) Chemical excitation                      (2) Photon excitation  
(3) Inelastic atomic collisions              (4) Thermal excitation
70. Ratio of probabilities of spontaneous emission and stimulated emission is :
- (1) Proportional to frequency ( $\nu$ )              (2) Independent of frequency ( $\nu$ )  
(3) Proportional to  $\nu^2$                       (4) Proportional to  $\nu^3$
71. Lenses of power + 3D and -5D are combined to form a compound lens. An object is placed at a distance of 50 cm from the lens. Its image will be formed at a distance from the lens :
- (1) 25 cm                      (2) 20 cm                      (3) 30 cm                      (4) 40 cm
72. Chromatic aberration in the formation of images by a lens arises because :
- (1) of non-paraxial rays  
(2) radii of curvature of two sides are not same  
(3) of the defects in grinding  
(4) The focal length varies with wavelength
73. One cannot see through fog because :
- (1) fog absorbs light  
(2) the refractive index of fog is infinity  
(3) light suffers total reflection at the droplets in fog  
(4) light is scattered by droplets in fog
74. A person is suffering from the defect of astigmatism. Its main reason is :
- (1) distance of the eye lens from retina is increased  
(2) power of accommodation of the eye is decreased  
(3) the cornea is not spherical  
(4) the distance of the eye lens from the retina is decreased
75. In a Fresnel biprism experiment, the two positions of lens give separation between the slits as 16 cm and 9 cm respectively. The actual distance of separation of slits is :
- (1) 12.5 cm                      (2) 12.0 cm                      (3) 13 cm                      (4) 14 cm

76. A thin mica sheet of thickness  $2 \times 10^{-6}$  m and refractive index  $\mu = 1.5$  is introduced in the path of one of the waves. The wavelength of the wave used is 5000 Å. The central bright maximum will shift :
- (1) 2 fringes upward (2) 2 fringes downward  
(3) 10 fringes upward (4) 10 fringes downward
77. A bag contains 5 red balls, 8 white balls and 10 black balls. If a ball is drawn from the bag, the probability that it is either white or black is :
- (1) 5/18 (2) 8/18 (3) 10/23 (4) 18/23
78. Sterling's formula states that for every large value of  $N$ ,  $\ln N!$  is equal to :
- (1)  $N!$  (2)  $N(\ln N - 1)$  (3)  $N \ln N$  (4)  $\frac{\ln N}{N}$
79. Boltzmann relation between entropy ( $s$ ) and thermodynamic probability ( $W$ ) is :
- (1)  $S = \ln W$  (2)  $S = \frac{\ln W}{k}$  (3)  $S = k \ln W$  (4)  $S = \frac{k}{\ln W}$
80. Maxwell-Boltzmann statistics is applicable for :
- (1) Photon (2) Ideal gas (3) Electron (4) Proton
81. Curie temperature is the temperature above which :
- (1) A paramagnetic material becomes diamagnetic  
(2) A ferromagnetic material becomes diamagnetic  
(3) A paramagnetic material becomes ferromagnetic  
(4) A ferromagnetic material becomes paramagnetic
82. The Poisson's equation in CGS Gaussian system is :
- (1)  $\nabla^2 V = -\frac{\rho}{\epsilon_0}$  (2)  $\nabla^2 V = -4\pi\rho$  (3)  $\nabla^2 V = -4\pi\epsilon_0$  (4)  $\nabla^2 V = 0$
83. An inductance of 2H and resistance of  $10\Omega$  are connected in series to a battery of 5V. The initial rate of change of current is :
- (1) 2.5 A/s (2) 2.0 A/s (3) 0.5 A/s (4) 0.25 A/s
84. A solenoid of resistance  $50\Omega$  and inductance 5mH is connected to 200V battery. The maximum energy stored is :
- (1) 4 mJ (2) 0.4 mJ (3) 40 mJ (4) 400 mJ



85. In LCR circuit if resistance increases, the quality factor :
- (1) Increases (2) Decreases  
(3) Remains constant (4) None of these
86. The phase difference between the voltage and current of LCR circuit in series at resonance is :
- (1)  $\pi$  (2)  $\pi/2$  (3) Zero (4)  $\pi/4$
87. A P-N junction diode can not be used :
- (1) as a rectifier  
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- (1) Decreases, increases respectively (2) Decreases, decreases respectively  
(3) Increases, decreases respectively (4) Increases, increases respectively
89. Emitter follower is an amplifier employing :
- (1) Voltage series feedback (2) Current series feedback  
(3) Voltage shunt feedback (4) Current shunt feedback
90. The time base of a CRO is developed by :
- (1) Sawtooth waveform (2) Square waveform  
(3) Triangular waveform (4) Sinusoidal waveform
91. The volume element in spherical polar co-ordinates is :
- (1)  $r dr \sin \theta d\theta d\phi$  (2)  $r^2 dr \sin \theta d\theta d\phi$   
(3)  $r^2 dr \sin \theta d\theta$  (4)  $r^3 dr \sin \theta d\theta d\phi$
92. Total kinetic energy of circular disc rolling on a table is :
- (1)  $\frac{3}{4} Mr^2 w^2$  (2)  $\frac{1}{2} Mr^2 w^2$   
(3)  $\frac{3}{4} M^2 r^2 w^2$  (4)  $\frac{1}{2} M^2 r^2 w^2$

93. An inclined plane makes an angle of  $30^\circ$  with the horizontal. A solid sphere rolling down the inclined plane from rest without slipping has a linear acceleration given by :
- (1)  $g/3$                       (2)  $2g/3$                       (3)  $5g/3$                       (4)  $5g/14$
94. The number of degrees of freedom of the particle moving on the circumference of a circle is :
- (1) 1                      (2) 2                      (3) 3                      (4) 6
95. The constraint on a particle moving on an ellipsoid under the influence of gravity is :
- (1) Holonomic                      (2) Nonholonomic  
(3) rheonomic                      (4) both holonomic and rheonomic
96. The homogeneity of time leads to the law of conservation of :
- (1) Linear momentum                      (2) Angular momentum  
(3) Energy                      (4) Parity
97. Three identical metal balls, each of radius  $R$ , are placed touching each other on a horizontal surface such that an equilateral triangle is formed when the centres of the three balls are joined. The centre of mass of the system is located at :
- (1) Horizontal surface                      (2) Centre of one of the balls  
(3) Line joining centres of any two balls                      (4) Point of intersection of their medians
98. Increase in length of a wire on stretching is 0.025%. If its Poisson's ratio is 0.4, then the percentage increase in diameter is :
- (1) 0.01                      (2) 0.02                      (3) 0.03                      (4) 0.04
99. A beam of metal supported at the two ends is loaded at the centre. The depression at the centre is proportional to :
- (1)  $Y^2$                       (2)  $Y$                       (3)  $1/Y$                       (4)  $1/Y^2$
100. The stress required to double the length of a wire of Young's modulus  $Y$  is :
- (1)  $Y/2$                       (2)  $2Y$                       (3)  $Y$                       (4)  $4Y$

(DO NOT OPEN THIS QUESTION BOOKLET BEFORE TIME OR UNTIL YOU  
ARE ASKED TO DO SO)

C

PG-EE-June, 2023

SET-X

SUBJECT : Physics

10459

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.**

- All questions are compulsory.**
- 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.
- 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.
- 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.
- 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.
- 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.**
- Use only **Black** or **Blue Ball Point Pen** of good quality in the OMR Answer-Sheet.
- 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.**

PG-EE-June, 2023/(Physics)(SET-X)/(C)

SEAL

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13. An inductance of  $2H$  and resistance of  $10\Omega$  are connected in series to a battery of  $5V$ . The initial rate of change of current is :
- (1)  $2.5 A/s$                       (2)  $2.0 A/s$                       (3)  $0.5 A/s$                       (4)  $0.25 A/s$
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  - (3) Voltage shunt feedback
  - (4) Current shunt feedback
20. The time base of a CRO is developed by :
- (1) Sawtooth waveform
  - (2) Square waveform
  - (3) Triangular waveform
  - (4) Sinusoidal waveform
21. The volume element in spherical polar co-ordinates is :
- (1)  $r dr \sin \theta d\theta d\phi$
  - (2)  $r^2 dr \sin \theta d\theta d\phi$
  - (3)  $r^2 dr \sin \theta d\theta$
  - (4)  $r^3 dr \sin \theta d\theta d\phi$
22. Total kinetic energy of circular disc rolling on a table is :
- (1)  $\frac{3}{4} Mr^2 w^2$
  - (2)  $\frac{1}{2} Mr^2 w^2$
  - (3)  $\frac{3}{4} M^2 r^2 w^2$
  - (4)  $\frac{1}{2} M^2 r^2 w^2$
23. An inclined plane makes an angle of  $30^\circ$  with the horizontal. A solid sphere rolling down the inclined plane from rest without slipping has a linear acceleration given by :
- (1)  $g/3$
  - (2)  $2g/3$
  - (3)  $5g/3$
  - (4)  $5g/14$
24. The number of degrees of freedom of the particle moving on the circumference of a circle is :
- (1) 1
  - (2) 2
  - (3) 3
  - (4) 6

25. The constraint on a particle moving on an ellipsoid under the influence of gravity is :
- (1) Holonomic (2) Nonholonomic  
(3) rheonomic (4) both holonomic and rheonomic
26. The homogeneity of time leads to the law of conservation of :
- (1) Linear momentum (2) Angular momentum  
(3) Energy (4) Parity
27. Three identical metal balls, each of radius  $R$ , are placed touching each other on a horizontal surface such that an equilateral triangle is formed when the centres of the three balls are joined. The centre of mass of the system is located at :
- (1) Horizontal surface  
(2) Centre of one of the balls  
(3) Line joining centres of any two balls  
(4) Point of intersection of their medians
28. Increase in length of a wire on stretching is 0.025%. If its Poisson's ratio is 0.4, then the percentage increase in diameter is :
- (1) 0.01 (2) 0.02 (3) 0.03 (4) 0.04
29. A beam of metal supported at the two ends is loaded at the centre. The depression at the centre is proportional to :
- (1)  $Y^2$  (2)  $Y$  (3)  $1/Y$  (4)  $1/Y^2$
30. The stress required to double the length of a wire of Young's modulus  $Y$  is :
- (1)  $Y/2$  (2)  $2Y$  (3)  $Y$  (4)  $4Y$
31. In a Ruby laser, the rod is surrounded by a helical photographic flash lamp filled with :
- (1) Chromium (2) Aluminium (3) Xenon (4) Neon
32. Half-life of a radioactive substance A is two times the half-life of another radioactive substance B. Initially the number of nuclei of A and B are  $N_A$  and  $N_B$  respectively. After three half-lives of A, number of nuclei of both are equal. Then the ratio  $N_A / N_B$  is :
- (1)  $1/4$  (2)  $1/8$  (3)  $1/3$  (4)  $1/6$

33. Radio carbon dating is done by estimating in specimen the :
- (1) Amount of ordinary carbon still present
  - (2) Amount of radio carbon still present
  - (3) Ratio of amount of  ${}_6C^{14}$  to  ${}_6C^{12}$  still present
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34. The electron emitted in beta radiation originates from :
- (1) Inner orbit of atoms
  - (2) Free electrons exciting in nuclei
  - (3) Decay of a neutron in a nucleus
  - (4) Photon escaping from the nucleus
35. Which of the following is **true** for a Neutrino ?
- (1) It is charged and has spin
  - (2) It is charged and has no spin
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36. The operation of a nuclear reactor is said to be critical, if the multiplication factor (K) has a value :
- (1) 1
  - (2) 1.5
  - (3) 2.1
  - (4) 2.5
37. The instrument which is suitable for absolute measurement of the activity of a  $\beta$ -active source is :
- (1) G. M. Counter
  - (2) Scintillation Counter
  - (3) Proportional Counter
  - (4) Ionization Counter
38. Primary cosmic rays are composed of very energetic :
- (1) Electrons
  - (2) Mesons
  - (3) Protons
  - (4) Neutrons
39. Nuclear fusion reaction occurs at temperatures of the order of :
- (1)  $10^3 K$
  - (2)  $10^7 K$
  - (3)  $10^2 K$
  - (4)  $10^4 K$
40. The radius of a nucleus with atomic mass number 7 is 2 Fermi. The radius of nucleus with atomic mass number 189 is :
- (1) 3 Fermi
  - (2) 4 Fermi
  - (3) 5 Fermi
  - (4) 6 Fermi
41. What does not change on polarization of light ?
- (1) Intensity
  - (2) Phase
  - (3) Frequency
  - (4) Wavelength



42. The Miller indices of the plane parallel to the  $X$  and  $Y$ -axes are :
- (1) (100)                      (2) (010)                      (3) (001)                      (4) (111)
43. A plane intercepts at  $a$ ,  $b/2$ ,  $3c$  in a simple cubic unit cell. The Miller indices of the plane are :
- (1) (132)                      (2) (261)                      (3) (361)                      (4) (123)
44. The number of lattice points in a primitive cell are :
- (1) 1                              (2)  $1/2$                               (3) 2                              (4)  $3/2$
45. The nearest neighbour distance in the case of bcc structure is :
- (1)  $(a\sqrt{3})/2$                       (2)  $(a\sqrt{2})/2$                       (3)  $2a/\sqrt{3}$                       (4)  $2a/\sqrt{2}$
46. When the potential difference between the electrodes of X-ray tube is increased, there take place an increase in :
- (1) Intensity                      (2) Frequency                      (3) Wavelength                      (4) Speed of X-rays
47. The packing factor of diamond cubic crystal structure is :
- (1) 60%                              (2) 56%                              (3) 90%                              (4) 34%
48. If 0.28 nm is the interionic distance in NaCl crystal, the lattice parameter is :
- (1) 0.14 nm                      (2) 0.56 nm                      (3) 0.08 nm                      (4) 0.41 nm
49. If the angle between the direction of the incident X-ray and the diffracted ray is  $16^\circ$ , the angle of incidence will be :
- (1)  $32^\circ$                               (2)  $24^\circ$                               (3)  $90^\circ$                               (4)  $82^\circ$
50. Which of the following statements is in accordance with Einstein's theory of specific heat of solids :
- (1) Specific heat drops linearly with increase of temperature
- (2) Specific heat drops linearly with decrease of temperature
- (3) Specific heat drops exponentially with decrease of temperature
- (4) Specific heat remains constant

51. If the temperatures of source and sink of a Carnot engine having efficiency  $\eta$  are each decreased by 100 K, then the efficiency :
- (1) Remains constant (2) Decreases  
(3) Increases (4) Becomes Zero
52. In a reversible process, the entropy of the universe :
- (1) Decreases (2) Increases  
(3) Remains unchanged (4) Fluctuates
53. Method which uses a list of well defined instruction to complete a task starting from a given initial state to end state is :
- (1) Program (2) Flow chart (3) Algorithm (4) Both (1) and (2)
54. On a T-S diagram, the isothermals are :
- (1) Straight lines parallel to the T-axis (2) Straight lines parallel to the S-axis  
(3) Straight lines inclined at any angle (4) Rectangular parabola
55. For an isolated thermodynamical system P, V, T, U and S represent the pressure, volume, temperature, internal energy and entropy respectively then the Gibb's potential (G) is defined as :
- (1)  $G = U - PV + TS$  (2)  $G = U + PV + TS$   
(3)  $G = U - PV - TS$  (4)  $G = U + PV - TS$
56. A fluid at high pressure in throttled through a narrow porous opening in a region of lower pressure without any transfer of heat. In such a process :
- (1) The entropy does not change (2) The Gibb's free energy remains constant  
(3) The entropy is decreased (4) The enthalpy of the fluid is constant
57. Which of the following is *not* Maxwell's equation ?
- (1)  $\left(\frac{\partial S}{\partial V}\right)_T = \left(\frac{\partial P}{\partial T}\right)_V$  (2)  $\left(\frac{\partial T}{\partial V}\right)_S = -\left(\frac{\partial P}{\partial S}\right)_V$   
(3)  $\left(\frac{\partial V}{\partial P}\right)_S = \left(\frac{\partial T}{\partial S}\right)_P$  (4)  $\left(\frac{\partial T}{\partial P}\right)_S = \left(\frac{\partial V}{\partial S}\right)_P$
58. The combined form of first and second law of thermodynamics is given by :
- (1)  $TdS = dU + PdV$  (2)  $dQ = TdS + PdV$   
(3)  $dU = TdS + dQ$  (4)  $TdS = dU + PdV$

59. To a fish under water, viewing obliquely a fisherman standing on the bank of a lake, the man looks :

- (1) Taller than what he actually is      (2) Shorter than what he actually is  
(3) The same height as he actually is      (4) depends on obliquity

60. Critical angle of light passing from glass to air is minimum for :

- (1) red      (2) green      (3) yellow      (4) violet

61. The number of sulphide atoms in the unit cell of zinc sulphide crystal is :

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

62. In Compton effect the transfer of energy becomes the maximum when the angle of scattering of the photon is :

- (1)  $90^\circ$       (2)  $180^\circ$       (3)  $60^\circ$       (4)  $30^\circ$

63. Davisson-Germer experiment is related to the phenomenon of :

- (1) Interference      (2) Diffraction  
(3) Reflection      (4) Polarization

64. The correct relation between group velocity ( $v_g$ ) and phase velocity ( $v_p$ ) is :

- (1)  $v_g = v_p - \lambda \frac{dv_p}{d\lambda}$       (2)  $v_g = v_p + \lambda \frac{dv_p}{d\lambda}$   
(3)  $v_g = v_p - \lambda \frac{dv_g}{d\lambda}$       (4)  $v_p = v_g - \frac{1}{\lambda} \frac{dv_g}{d\lambda}$

65. The uncertainty principle tells us that :

- (1) A particle can have only position but no momentum.  
(2) A particle can have only momentum but no position.  
(3) One can determine simultaneously the position and momentum of a particle.  
(4) One cannot determine simultaneously the position and momentum of a particle.

66. In three dimensions the momentum operator  $\hat{p}$  is :

- (1)  $\hat{p} = -\frac{\hbar}{i} \nabla$       (2)  $\hat{p} = -\frac{i\hbar}{\nabla}$       (3)  $\hat{p} = \frac{\hbar}{i} \nabla$       (4)  $\hat{p} = \frac{\hbar}{i} \nabla$

67. The value of  $\left[ \hat{x}, \frac{\hat{d}}{dx} \right]$  is :
- (1) 0                      (2) 1                      (3) -1                      (4)  $\infty$
68. The energy of a particle in the  $n$ th quantum state in a one-dimensional closed box is proportional to :
- (1)  $n$                       (2)  $n^2$                       (3)  $\frac{1}{n}$                       (4)  $\frac{1}{n^2}$
69. The ground state energy of the one-dimensional oscillator is :
- (1)  $\hbar\omega$                       (2)  $\frac{1}{2}\hbar\omega$                       (3)  $\frac{3}{2}\hbar\omega$                       (4)  $\infty$
70. In case of a potential step of height  $V_0$ , for a particle of energy  $E < V_0$ , the transmittance is :
- (1) Zero                      (2) Finite non-zero                      (3) Infinite                      (4) 1
71. The eigen value associated with an Hermitian operator is :
- (1) Imaginary                      (2) Complex                      (3) Real                      (4) None of these
72. The doublets observed in alkali spectra are due to :
- (1) Screening of the K electron                      (2) Spin-orbit interaction of the electron  
(3) Pressure of isotopes                      (4) Pressure of isotones
73. The value of Lande g factor for the doublet term  $^2D_{3/2}$  is :
- (1)  $2/5$                       (2)  $3/5$                       (3)  $4/5$                       (4)  $6/5$
74. The splitting of single line singlet into three component lines in the presence of magnetic field is known as :
- (1) Paschen-Back effect                      (2) normal Zeeman effect  
(3) Anomalous Zeeman effect                      (4) Stark effect
75. For a diatomic molecule, Raman lines are observed due to appreciable change in :
- (1) Pressure                      (2) Shape                      (3) Polarizability                      (4) Solubility

76. Rotational constant (B) is related to moment of inertia (I) through the relation :  
 (1)  $B = h/8\pi^2 IC$  (2)  $B = 2h/8\pi^2 I^2 C^2$  (3)  $B = 3h/\pi^2 IC$  (4)  $B = hIC/8\pi^2$
77. The exciting line in an experiment is 5460 Å and the Stoke's line is at 5520 Å. The wavelength of anti-Stoke's line is :  
 (1) 5200 Å (2) 4200 Å (3) 5401 Å (4) 5308 Å
78. In the first order Stark effect in hydrogen atom, the ground state :  
 (1) Splits in two levels (2) Splits in three levels  
 (3) Splits in four levels (4) Does not split
79. In He-Ne laser the population inversion is achieved by :  
 (1) Chemical excitation (2) Photon excitation  
 (3) Inelastic atomic collisions (4) Thermal excitation
80. Ratio of probabilities of spontaneous emission and stimulated emission is :  
 (1) Proportional to frequency ( $\nu$ ) (2) Independent of frequency ( $\nu$ )  
 (3) Proportional to  $\nu^2$  (4) Proportional to  $\nu^3$
81. The bulk modulus of a rubber is  $9.1 \times 10^8 N/m^2$ . To what depth (approximately) a rubber ball be taken in a lake so that it's volume is decreased by 0.1% ?  
 (1) 25 m (2) 100 m (3) 200 m (4) 500 m
82. If the masses of all molecules of a gas are halved and their speeds doubled, then the ratio of initial and final pressures would be :  
 (1) 2 : 1 (2) 1 : 2 (3) 4 : 1 (4) 1 : 4
83. The root mean square velocity of the molecules of a gas is 1260 m/s. The most probable speed of the molecules is :  
 (1) 1029 m/s (2) 1161 m/s (3) 1671 m/s (4) 917 m/s
84. Two photons approach each other. Their relative velocity will be :  
 (1) Zero (2) Less than C (3) More than C (4) C
85. The *apparent* length of a meter rod moving parallel to it's length with velocity 0.8C will be :  
 (1) 0.5 m (2) 0.6 m (3) 1 m (4) 1.5 m

86. The equation  $\vec{\nabla} \times \vec{E} = -\frac{\partial \vec{B}}{\partial t}$  represents :
- (1) Gauss's law (2) Coulomb's law  
(3) Ampere's law (4) Faraday's law
87. An electromagnetic wave going through vacuum is described by  $E = E_0 \sin(kx - wt)$ . Which of the following is independent of wavelength ?
- (1)  $k$  (2)  $w$  (3)  $w/k$  (4)  $kw$
88. The electric field intensity on the surface of a solid charged sphere of radius  $r$  and volume charge density  $\rho$  is given by :
- (1)  $\rho r / 3 \epsilon_0$  (2)  $\frac{1}{4\pi \epsilon_0} \frac{\rho}{r}$  (3) zero (4)  $\frac{5\rho r}{6 \epsilon_0}$
89. Liquids and gases never exhibit :
- (1) Diamagnetic properties (2) Paramagnetic properties  
(3) Ferromagnetic properties (4) Ferromagnetic properties
90. Electromagnets are made of soft iron because soft iron has :
- (1) Low retentivity and low coercivity  
(2) High retentivity and high coercivity  
(3) Low retentivity and high coercivity  
(4) High retentivity and low coercivity
91. Particles obeying Bose-Einstein statistics have :
- (1) any spin (2) integral spin (3) half integral spin (4) zero spin
92. Planck's law of radiation can be derived by applying :
- (1) Maxwell-Boltzmann Statistics (2) Bose-Einstein Statistics  
(3) Fermi-Dirac Statistics (4) None of these
93. The number of co-ordinates in the phase space of a single particle is :
- (1) 2 (2) 3 (3) 5 (4) 6
94. If a shift of 200 fringes is observed when the movable mirror is shifted through 0.0589 mm, the wavelength of light used in Michelson's Interferometer is :
- (1) 5890 Å (2) 2945 Å (3) 2006 Å (4) 1475 Å

95. A wedge shaped film is viewed with light of  $\lambda = 6 \times 10^{-5}$  cm. There are 10 fringes per cm. The angle of wedge is :
- (1)  $1 \times 10^{-4}$  radian (2)  $2 \times 10^{-4}$  radian (3)  $3 \times 10^{-4}$  radian (4)  $4 \times 10^{-4}$  radian
96. Which optical instrument is employed to obtain interference fringes of various shapes ?
- (1) Michelson interferometer (2) Fabrey-Perot interferometer  
(3) Newton rings (4) Fresnel's biprism
97. If white light is used in the Newton's rings experiment, the colour observed in the reflected light is complementary to that observed in the transmitted light through the same point. This is due to :
- (1)  $90^\circ$  change of phase in one of the reflected waves  
(2)  $180^\circ$  change of phase in one of the reflected waves  
(3)  $135^\circ$  change of phase in one of the reflected waves  
(4)  $45^\circ$  change of phase in one of the reflected waves
98. Which of the following is a dichoric crystal ?
- (1) Quartz (2) Tourmaline (3) Mica (4) Selenite
99. A calcite crystal is placed over a dot on a piece of paper and rotated. On seeing through the calcite, one will see :
- (1) one dot (2) two stationary dots  
(3) two rotating dots (4) one dot rotating about the other
100. Which of the following is *correct* statement ?
- (1) The dispersive power of a grating decreases with the increase in the order of spectrum.  
(2) The dispersive power of a grating increases with the increase in the order of spectrum.  
(3) The dispersive power of a grating decrease with decrease of grating element.  
(4) The dispersive power of a grating does not depend on grating element.

(DO NOT OPEN THIS QUESTION BOOKLET BEFORE TIME OR UNTIL YOU  
ARE ASKED TO DO SO)

**D**

**PG-EE-June, 2023**

**SET-X**

**SUBJECT : Physics**

**10404**

Sr. No. ....

Time : 1½ 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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- All questions are compulsory.**
- 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.
- 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.
- 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.
- 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.
- 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.**
- Use only **Black or Blue Ball Point Pen** of good quality in the OMR Answer-Sheet.
- 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.**



1. The bulk modulus of a rubber is  $9.1 \times 10^8 \text{ N/m}^2$ . To what depth (approximately) a rubber ball be taken in a lake so that its volume is decreased by 0.1% ?  
 (1) 25 m                      (2) 100 m                      (3) 200 m                      (4) 500 m
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- (1) Amount of ordinary carbon still present  
(2) Amount of radio carbon still present  
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 (2) A particle can have only momentum but no position.  
 (3) One can determine simultaneously the position and momentum of a particle.  
 (4) One cannot determine simultaneously the position and momentum of a particle.

26. In three dimensions the momentum operator  $\hat{p}$  is :
- (1)  $\hat{p} = -\frac{\hbar}{i} \nabla$       (2)  $\hat{p} = -\frac{i\hbar}{\nabla}$       (3)  $\hat{p} = \frac{\hbar}{i} \nabla$       (4)  $\hat{p} = \frac{\hbar}{i} \nabla$
27. The value of  $\left[ \hat{x}, \frac{\hat{d}}{dx} \right]$  is :
- (1) 0      (2) 1      (3) -1      (4)  $\infty$
28. The energy of a particle in the  $n$ th quantum state in a one-dimensional closed box is proportional to :
- (1)  $n$       (2)  $n^2$       (3)  $\frac{1}{n}$       (4)  $\frac{1}{n^2}$
29. The ground state energy of the one-dimensional oscillator is :
- (1)  $\hbar\omega$       (2)  $\frac{1}{2} \hbar\omega$       (3)  $\frac{3}{2} \hbar\omega$       (4)  $\infty$
30. In case of a potential step of height  $V_0$ , for a particle of energy  $E < V_0$ , the transmittance is :
- (1) Zero      (2) Finite non-zero      (3) Infinite      (4) 1
31. Particles obeying Bose-Einstein statistics have :
- (1) any spin      (2) integral spin  
(3) half integral spin      (4) zero spin
32. Planck's law of radiation can be derived by applying :
- (1) Maxwell-Boltzmann Statistics      (2) Bose-Einstein Statistics  
(3) Fermi-Dirac Statistics      (4) None of these
33. The number of co-ordinates in the phase space of a single particle is :
- (1) 2      (2) 3      (3) 5      (4) 6
34. If a shift of 200 fringes is observed when the movable mirror is shifted through 0.0589 mm, the wavelength of light used in Michelson's Interferometer is :
- (1) 5890 Å      (2) 2945 Å      (3) 2006 Å      (4) 1475 Å

35. A wedge shaped film is viewed with light of  $\lambda = 6 \times 10^{-5}$  cm. There are 10 fringes per cm. The angle of wedge is :  
(1)  $1 \times 10^{-4}$  radian (2)  $2 \times 10^{-4}$  radian (3)  $3 \times 10^{-4}$  radian (4)  $4 \times 10^{-4}$  radian
36. Which optical instrument is employed to obtain interference fringes of various shapes ?  
(1) Michelson interferometer (2) Fabrey-Perot interferometer  
(3) Newton rings (4) Fresnel's biprism
37. If white light is used in the Newton's rings experiment, the colour observed in the reflected light is complementary to that observed in the transmitted light through the same point. This is due to :  
(1)  $90^\circ$  change of phase in one of the reflected waves  
(2)  $180^\circ$  change of phase in one of the reflected waves  
(3)  $135^\circ$  change of phase in one of the reflected waves  
(4)  $45^\circ$  change of phase in one of the reflected waves
38. Which of the following is a dichoric crystal ?  
(1) Quartz (2) Tourmaline (3) Mica (4) Selenite
39. A calcite crystal is placed over a dot on a piece of paper and rotated. On seeing through the calcite, one will see :  
(1) one dot (2) two stationary dots  
(3) two rotating dots (4) one dot rotating about the other
40. Which of the following is *correct* statement ?  
(1) The dispersive power of a grating decreases with the increase in the order of spectrum.  
(2) The dispersive power of a grating increases with the increase in the order of spectrum.  
(3) The dispersive power of a grating decrease with decrease of grating element.  
(4) The dispersive power of a grating does not depend on grating element.
41. If the temperatures of source and sink of a Carnot engine having efficiency  $\eta$  are each decreased by 100 K, then the efficiency :  
(1) Remains constant (2) Decreases  
(3) Increases (4) Becomes Zero

42. In a reversible process, the entropy of the universe :
- (1) Decreases (2) Increases  
(3) Remains unchanged (4) Fluctuates
43. Method which uses a list of well defined instruction to complete a task starting from a given initial state to end state is :
- (1) Program (2) Flow chart (3) Algorithm (4) Both (1) and (2)
44. On a T-S diagram, the isothermals are :
- (1) Straight lines parallel to the T-axis (2) Straight lines parallel to the S-axis  
(3) Straight lines inclined at any angle (4) Rectangular parabola
45. For an isolated thermodynamical system P, V, T, U and S represent the pressure, volume, temperature, internal energy and entropy respectively then the Gibb's potential (G) is defined as :
- (1)  $G = U - PV + TS$  (2)  $G = U + PV + TS$   
(3)  $G = U - PV - TS$  (4)  $G = U + PV - TS$
46. A fluid at high pressure in throttled through a narrow porous opening in a region of lower pressure without any transfer of heat. In such a process :
- (1) The entropy does not change (2) The Gibb's free energy remains constant  
(3) The entropy is decreased (4) The enthalpy of the fluid is constant
47. Which of the following is *not* Maxwell's equation ?
- (1)  $\left(\frac{\partial S}{\partial V}\right)_T = \left(\frac{\partial P}{\partial T}\right)_V$  (2)  $\left(\frac{\partial T}{\partial V}\right)_S = -\left(\frac{\partial P}{\partial S}\right)_V$   
(3)  $\left(\frac{\partial V}{\partial P}\right)_S = \left(\frac{\partial T}{\partial S}\right)_P$  (4)  $\left(\frac{\partial T}{\partial P}\right)_S = \left(\frac{\partial V}{\partial S}\right)_P$
48. The combined form of first and second law of thermodynamics is given by :
- (1)  $TdS = dU + PdV$  (2)  $dQ = TdS + PdV$   
(3)  $dU = TdS + dQ$  (4)  $TdS = dU + PdV$
49. To a fish under water, viewing obliquely a fisherman standing on the bank of a lake, the man looks :
- (1) Taller than what he actually is (2) Shorter than what he actually is  
(3) The same height as he actually is (4) depends on obliquity

50. Critical angle of light passing from glass to air is minimum for :  
(1) red (2) green (3) yellow (4) violet
51. Curie temperature is the temperature above which :  
(1) A paramagnetic material becomes diamagnetic  
(2) A ferromagnetic material becomes diamagnetic  
(3) A paramagnetic material becomes ferromagnetic  
(4) A ferromagnetic material becomes paramagnetic
52. The Poisson's equation in CGS Gaussian system is :  
(1)  $\nabla^2 V = -\frac{\rho}{\epsilon_0}$  (2)  $\nabla^2 V = -4\pi\rho$  (3)  $\nabla^2 V = -4\pi\epsilon_0$  (4)  $\nabla^2 V = 0$
53. An inductance of 2H and resistance of  $10\Omega$  are connected in series to a battery of 5V. The initial rate of change of current is :  
(1) 2.5 A/s (2) 2.0 A/s (3) 0.5 A/s (4) 0.25 A/s
54. A solenoid of resistance  $50\Omega$  and inductance 5mH is connected to 200V battery. The maximum energy stored is :  
(1) 4 mJ (2) 0.4 mJ (3) 40 mJ (4) 400 mJ
55. In LCR circuit if resistance increases, the quality factor :  
(1) Increases (2) Decreases  
(3) Remains constant (4) None of these
56. The phase difference between the voltage and current of LCR circuit in series at resonance is :  
(1)  $\pi$  (2)  $\pi/2$  (3) Zero (4)  $\pi/4$
57. A P-N junction diode can not be used :  
(1) as a rectifier  
(2) for increasing the amplitude of an AC signal  
(3) for getting light radiation  
(4) for converting light energy into electrical energy

58. The bandwidth and voltage gain of an amplifier using negative feedback :
- (1) Decreases, increases respectively      (2) Decreases, decreases respectively  
(3) Increases, decreases respectively      (4) Increases, increases respectively
59. Emitter follower is an amplifier employing :
- (1) Voltage series feedback      (2) Current series feedback  
(3) Voltage shunt feedback      (4) Current shunt feedback
60. The time base of a CRO is developed by :
- (1) Sawtooth waveform      (2) Square waveform  
(3) Triangular waveform      (4) Sinusoidal waveform
61. Lenses of power + 3D and -5D are combined to form a compound lens. An object is placed at a distance of 50 cm from the lens. Its image will be formed at a distance from the lens :
- (1) 25 cm      (2) 20 cm      (3) 30 cm      (4) 40 cm
62. Chromatic aberration in the formation of images by a lens arises because :
- (1) of non-paraxial rays  
(2) radii of curvature of two sides are not same  
(3) of the defects in grinding  
(4) The focal length varies with wavelength
63. One cannot see through fog because :
- (1) fog absorbs light  
(2) the refractive index of fog is infinity  
(3) light suffers total reflection at the droplets in fog  
(4) light is scattered by droplets in fog
64. A person is suffering from the defect of astigmatism. Its main reason is :
- (1) distance of the eye lens from retina is increased  
(2) power of accommodation of the eye is decreased  
(3) the cornea is not spherical  
(4) the distance of the eye lens from the retina is decreased





75. The nearest neighbour distance in the case of bcc structure is :  
 (1)  $(a\sqrt{3})/2$       (2)  $(a\sqrt{2})/2$       (3)  $2a/\sqrt{3}$       (4)  $2a/\sqrt{2}$
76. When the potential difference between the electrodes of X-ray tube is increased, there take place an increase in :  
 (1) Intensity      (2) Frequency      (3) Wavelength      (4) Speed of X-rays
77. The packing factor of diamond cubic crystal structure is :  
 (1) 60%      (2) 56%      (3) 90%      (4) 34%
78. If 0.28 nm is the interionic distance in NaCl crystal, the lattice parameter is :  
 (1) 0.14 nm      (2) 0.56 nm      (3) 0.08 nm      (4) 0.41 nm
79. If the angle between the direction of the incident X-ray and the diffracted ray is  $16^\circ$ , the angle of incidence will be :  
 (1)  $32^\circ$       (2)  $24^\circ$       (3)  $90^\circ$       (4)  $82^\circ$
80. Which of the following statements is in accordance with Einstein's theory of specific heat of solids :  
 (1) Specific heat drops linearly with increase of temperature  
 (2) Specific heat drops linearly with decrease of temperature  
 (3) Specific heat drops exponentially with decrease of temperature  
 (4) Specific heat remains constant
81. The volume element in spherical polar co-ordinates is :  
 (1)  $r dr \sin \theta d\theta d\phi$       (2)  $r^2 dr \sin \theta d\theta d\phi$   
 (3)  $r^2 dr \sin \theta d\theta$       (4)  $r^3 dr \sin \theta d\theta d\phi$
82. Total kinetic energy of circular disc rolling on a table is :  
 (1)  $\frac{3}{4} Mr^2 w^2$       (2)  $\frac{1}{2} Mr^2 w^2$   
 (3)  $\frac{3}{4} M^2 r^2 w^2$       (4)  $\frac{1}{2} M^2 r^2 w^2$

83. An inclined plane makes an angle of  $30^\circ$  with the horizontal. A solid sphere rolling down the inclined plane from rest without slipping has a linear acceleration given by :
- (1)  $g/3$                       (2)  $2g/3$                       (3)  $5g/3$                       (4)  $5g/14$
84. The number of degrees of freedom of the particle moving on the circumference of a circle is :
- (1) 1                      (2) 2                      (3) 3                      (4) 6
85. The constraint on a particle moving on an ellipsoid under the influence of gravity is :
- (1) Holonomic                      (2) Nonholonomic  
(3) rheonomic                      (4) both holonomic and rheonomic
86. The homogeneity of time leads to the law of conservation of :
- (1) Linear momentum                      (2) Angular momentum  
(3) Energy                      (4) Parity
87. Three identical metal balls, each of radius  $R$ , are placed touching each other on a horizontal surface such that an equilateral triangle is formed when the centres of the three balls are joined. The centre of mass of the system is located at :
- (1) Horizontal surface  
(2) Centre of one of the balls  
(3) Line joining centres of any two balls  
(4) Point of intersection of their medians
88. Increase in length of a wire on stretching is 0.025%. If its Poisson's ratio is 0.4, then the percentage increase in diameter is :
- (1) 0.01                      (2) 0.02                      (3) 0.03                      (4) 0.04
89. A beam of metal supported at the two ends is loaded at the centre. The depression at the centre is proportional to :
- (1)  $Y^2$                       (2)  $Y$                       (3)  $1/Y$                       (4)  $1/Y^2$
90. The stress required to double the length of a wire of Young's modulus  $Y$  is :
- (1)  $Y/2$                       (2)  $2Y$                       (3)  $Y$                       (4)  $4Y$

91. The eigen value associated with an Hermitian operator is :  
 (1) Imaginary (2) Complex (3) Real (4) None of these
92. The doublets observed in alkali spectra are due to :  
 (1) Screening of the K electron (2) Spin-orbit interaction of the electron  
 (3) Pressure of isotopes (4) Pressure of isotones
93. The value of Lande g factor for the doublet term  ${}^2D_{3/2}$  is :  
 (1)  $2/5$  (2)  $3/5$  (3)  $4/5$  (4)  $6/5$
94. The splitting of single line singlet into three component lines in the presence of magnetic field is known as :  
 (1) Paschen-Back effect (2) normal Zeeman effect  
 (3) Anomalous Zeeman effect (4) Stark effect
95. For a diatomic molecule, Raman lines are observed due to appreciable change in :  
 (1) Pressure (2) Shape (3) Polarizability (4) Solubility
96. Rotational constant (B) is related to moment of inertia (I) through the relation :  
 (1)  $B = h/8\pi^2 IC$  (2)  $B = 2h/8\pi^2 I^2 C^2$   
 (3)  $B = 3h/\pi^2 IC$  (4)  $B = hIC/8\pi^2$
97. The exciting line in an experiment is  $5460 \text{ \AA}$  and the Stoke's line is at  $5520 \text{ \AA}$ . The wavelength of anti-Stoke's line is :  
 (1)  $5200 \text{ \AA}$  (2)  $4200 \text{ \AA}$  (3)  $5401 \text{ \AA}$  (4)  $5308 \text{ \AA}$
98. In the first order Stark effect in hydrogen atom, the ground state :  
 (1) Splits in two levels (2) Splits in three levels  
 (3) Splits in four levels (4) Does not split
99. In He-Ne laser the population inversion is achieved by :  
 (1) Chemical excitation (2) Photon excitation  
 (3) Inelastic atomic collisions (4) Thermal excitation
100. Ratio of probabilities of spontaneous emission and stimulated emission is :  
 (1) Proportional to frequency ( $\nu$ ) (2) Independent of frequency ( $\nu$ )  
 (3) Proportional to  $\nu^2$  (4) Proportional to  $\nu^3$

ANSWER KEYS ENTRANCE EXAM OF M.SC.(PHYSICS) 2 YEAR SESSION 2023-24				
Q. NO.	A	B	C	D
1	2	2	1	2
2	1	2	4	2
3	4	2	4	1
4	1	1	3	4
5	2	4	2	2
6	3	3	1	4
7	4	3	4	3
8	1	2	2	1
9	3	2	3	3
10	3	1	2	1
11	2	2	4	3
12	2	1	2	2
13	1	4	1	3
14	4	1	3	3
15	2	3	2	3
16	4	1	3	1
17	3	2	2	3
18	1	2	3	3
19	3	4	1	2
20	1	2	1	4
21	4	3	2	2
22	2	3	1	2
23	1	3	4	2
24	3	2	1	1
25	2	4	2	4
26	3	4	3	3
27	2	3	4	3
28	3	1	1	2
29	1	1	3	2
30	1	4	3	1
31	3	2	3	2
32	3	2	2	1
33	3	1	3	4
34	2	4	3	1
35	4	2	3	3
36	4	4	1	1
37	3	3	3	2
38	1	1	3	2
39	1	3	2	4
40	4	1	4	2
41	1	3	3	3
42	4	2	3	3
43	4	3	3	3
44	3	3	1	2
45	2	3	1	4
46	1	1	2	4
47	4	3	4	3
48	2	3	2	1
49	3	2	4	1
50	2	4	3	4

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ANSWER KEYS ENTRANCE EXAM OF M.SC.(PHYSICS) 2 YEAR SESSION 2023-24				
Q. NO.	A	B	C	D
51	2	3	3	4
52	1	3	3	2
53	4	3	3	1
54	1	1	2	3
55	3	1	4	2
56	1	2	4	3
57	2	4	3	2
58	2	2	1	3
59	4	4	1	1
60	2	3	4	1
61	3	3	2	1
62	3	2	2	4
63	3	3	2	4
64	1	2	1	3
65	1	3	4	2
66	2	1	3	1
67	4	3	3	4
68	2	4	2	2
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73	2	4	3	3
74	1	3	2	1
75	4	2	3	1
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77	3	4	3	4
78	2	2	4	2
79	2	3	3	4
80	1	2	4	3
81	3	4	2	2
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84	2	3	4	1
85	3	2	2	2
86	1	3	4	3
87	3	2	3	4
88	4	3	1	1
89	3	1	3	3
90	4	1	1	3
91	3	2	2	3
92	2	1	1	2
93	3	4	4	3
94	3	1	1	2
95	3	2	3	3
96	1	3	1	1
97	3	4	2	3
98	3	1	2	4
99	2	3	4	3
100	4	3	2	4

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