Total No. of Printed Pages : 13

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CPG-EE-2018 (Physics)-(SET-Y)

A

10417

Sr. No. .....

Time : **1½ Hours** Total Questions : **100** Max. Marks : **100**

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

Candidate's Name _____ Date of Birth _____

Father's Name _____ Mother's Name _____

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

SEAL

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Amitvelh Yadav/30/6/18
05.45 pm

1. Two particles of rest mass m_0 approach each other with equal and opposite velocity v, in the laboratory frame. The total energy of one particle as measured in the rest frame of other is :

(1) $E = m_0c^2$ (2) $E = 2m_0c^2$

(3) $E = 3m_0c^2$ (4) $E = 1/2\,m_0c^2$

2. Two masses m_1 and m_2 connected by a spring of spring constant k rest on a frictionless surface. If the masses are pulled apart and let go, the time period of oscillation is :

(1) $T = 2\pi\sqrt{\frac{1}{k}\left(\frac{m_1m_2}{m_1+m_2}\right)}$ (2) $T = 2\pi\sqrt{k\left(\frac{m_1+m_2}{m_1m_2}\right)}$

(3) $T = 2\pi\sqrt{\frac{m_1}{k}}$ (4) $T = 2\pi\sqrt{\frac{m_2}{k}}$

3. A body moves a distance of 10 m along a straight line under the action of force of 5 Newton. If the work done is 25 J, the angle which the force makes with the direction of motion of the body is :

(1) 90° (2) 60° (3) 30° (4) 0°

4. A body of mass m slide down an inclined plane making an angle of 45° with the horizontal. If the coefficient of friction between the body and the plane be 0.3, the acceleration of the body is approximately equal to :

(1) 0.49 g (2) 0.25 g (3) 1.5 g (4) 2.5 g

5. An electron has mass of 9.11×10^{-31} kg. It revolves about the nucleus in a circular orbit of radius 5.29×10^{-11} m at a speed of 2.2×10^6 m/s. The linear momentum of the electron in this system will be :

(1) 1.1×10^{34} kg-m/s^2 (2) 2.0×10^{-24} kg-m/s

(3) 1.1×10^{-24} kg-m/s^2 (4) 4.1×10^{-34} kg-m/s^2

6. The moment of inertia of the body does not depend upon :

(1) mass of the body

(2) the distribution of mass in the body

(3) angular velocity of the body

(4) the axis of the rotation of the body

7. A flywheel is a uniform disc of mass 72 kg and radius 50 cm. What is the kinetic energy when it is rotating at 70 rpm ?

(1) 241.8 J (2) 300 J (3) 134.6 J (4) 34.56 J

8. A particle moved from position $r_1 = 3i + 2j - 6k$ to position $r_2 = 4i + j + 3k$ N. What is the work done ?

(1) 1 J (2) 0.01 J (3) 10 J (4) 100 J

9. If $0.5i + 0.8j + ck$ is a unit vector. Then c is equal to :

(1) $\sqrt{0.89}$ (2) 0.2 (3) 0.3 (4) $\sqrt{0.11}$

10. The field due to an electric dipole at an axial point E_1, of the dipole and at a point on the perpendicular bisector of dipole E_2 are related as :

(1) $E_1 = E_2$ (2) $E_1 = 2E_2$ (3) $2E_1 = E_2$ (4) $E_1 = 4E_2$

11. If the potential difference between two points 2 cm apart in an electric field of 20 V, the electric field intensity between these points will be around :

(1) 20 V/m (2) 40 V/m (3) 10 V/m (4) 10 V/cm

12. If a positive charge q moving with velocity, v through a point in a magnetic field experiences a deflecting force F, then the magnetic induction B at that point will depend upon :

(1) q (2) v (3) F (4) q, v, and F

13. The permeability of para and ferromagnetic materials are :

(1) greater than unity (2) less than unity

(3) equal to unity (4) negative

14. Poynting vector is expressed as :

(1) $(H \times E)$ (2) $(E \times H)$ (3) $(E \times H).dS$ (4) $(H \times E).dS$

15. Young's modulus (Y), Modulus of rigidity (η) and Poisson ratio (σ) are related as :

(1) $Y = \frac{2\eta}{(1+\sigma)}$ (2) $\sigma = \frac{2Y}{(1+\eta)}$

(3) $\frac{Y}{\eta} = 2(1+\sigma)$ (4) $2Y = \eta(1 + \sigma)$

16. The force required to stretch a steel wire to double its length when its area of cross-section is 1 sq.cm and Young modulus of 2×10^{11} N/m^2 :

(1) 2×10^7 N (2) 4.56×10^9 N

(3) 6.34×10^5 N (4) 1.5×10^3 N

17. The mean kinetic energy E per unit volume and the pressure P of a gas are related as :

(1) P = 2/3 E (2) P = 3/2 E

(3) P = 1/2 E (4) P = $\sqrt{3}$/2 E

18. The law of equipartition of energy was postulated by :

(1) Maxwell (2) Boltzman (3) Stefan (4) Weins

19. The viscosity of gas is directly proportional to :

(1) temperature (2) square root of temperature

(3) characteristic gas constant (4) density of gas

20. A reference frame attached to the earth :

(1) is an inertial frame by definition

(2) cannot be an inertial frame because the earth is revolving round the sun

(3) is an inertial frame because Newton's laws are applicable in this frame

(4) cannot be an inertial frame because the earth is rotating about its own axis

21. An electron has a rest mass of 9.11×10^{-31} kg when its velocity of 0.9c the speed of light, its mass will be :

(1) 10.5×10^{-31} kg (2) 64.4×10^{-31} kg

(3) 20.9×10^{-31} kg (4) 6.37×10^{-37} kg

22. A rod of length 2 m moves with a velocity of 10^8 m/s relative to an observer at rest on the earth. What is the apparent length of the rod appearing to observer ?

(1) 11.78 m (2) 8.34 m (3) 55.4 m (4) 1.885 m

23. The fraction of electrons excited across the energy gap in Germanium (Eg = 0.7 eV) at room temperature (300 K) is :

(1) 7×10^{-18} (2) 1.7×10^{-12} (3) 4×10^{-12} (4) 1.3×10^{-6}

24. The degeneracy of the quantum states with $(n_x^2 + n_y^2 + n_z^2) = 6$ is :

(1) 12 (2) 24 (3) 48 (4) 8

25. At 0 K, the probability of finding an electron at energy level E is unity, when :

(1) $E = E_F$ (2) $E > E_F$ (3) $E < E_F$ (4) $E >> E_F$

26. The reverse saturation current in a p-n diode :

(1) increases (2) decreases

(3) remains constant (4) oscillates

27. The phase difference between the input and output voltages of a transistor connected in common emitter arrangement is :

(1) 360° (2) 180° (3) 90° (4) 270°

28. The DC current gain of a common-base transistor is 0.956 and emitter current is 10 mA. The base current value is :

(1) 0.66 mA (2) 0.38 mA (3) 0.25 mA (4) 0.44 mA

29. The electrical power output of a photodiode is maximum when a :

(1) Small forward current flows through it, irrespective of the bias

(2) Small forward bias exists across it

(3) Large reverse bias exists across it

(4) Small reverse bias exists across it

30. A common-emitter transistor has a typical value of gain (β) as 50 and the collector current is 10 mA. The emitter current is :

(1) 10.2 mA (2) 45.8 mA (3) 22.4 mA (4) 12.5 mA

31. The type of flip-flop is used to store the data in registers :

(1) D flip-flop (2) RS flip-flop

(3) JK flip-flop (4) T flip-flop

32. The flash memories find application in :

(1) super computers (2) mainframe systems

(3) distributed system (4) portable devices

33. With an amount of 110 J of heat is added to a gaseous system, whose internal energy increases by 40 J. Then the amount of external work done is :

(1) 120 J (2) 60 J (3) 70 J (4) 30 J

34. In the Carnot engine when heat is taken from the source its temperature :

(1) remains constant (2) increases

(3) decreases (4) fluctuate

35. The entropy at absolute zero of system is :

(1) tends to increase (2) zero

(3) maximum (4) fluctuate

36. Maxwell's thermodynamic relations are valid for :

(1) closed system

(2) open system

(3) a thermodynamic system in equilibrium

(4) only reversible process

37. The standard Gibbs energy change accompanying a spontaneous process has what property ?

(1) is always larger than the internal energy change

(2) is greater than zero

(3) is less than or equal to zero

(4) it has no restrictions on its value

38. When the white light enters in a lens, it undergoes a change in :

(1) frequency (2) wavelength

(3) velocity (4) wavelength and velocity

39. A double convex air bubble in water will act like a :

(1) concave lens (2) convex lens

(3) plane glass (4) concave mirror

40. Two thin lenses are in contact and the focal length of the combination is 80 cm. If the focal length of one of the lenses be 20 cm, the power of the other lens is :

(1) 1.89 diopters (2) 6 diopters

(3) –1.4 diopters (4) –3.75 diopters

41. Chromatic aberration is the product of :

(1) dispersive power × focal length of red ray

(2) dispersive power × mean focal length

(3) 1/ dispersive power × mean focal length

(4) dispersive power × 1/ mean focal length

42. The phenomenon of interference is used to prove that light is :

(1) longitudinal (2) transverse

(3) stationary wave (4) quantized

43. Two waves having the intensities in the ratio of 9 : 1 produce interference. The ratio of maximum to minimum intensity is equal to :

(1) 10 : 8 (2) 9 : 1 (3) 4 : 1 (4) 2 : 1

44. Two straight and narrow parallel slits 1 mm apart are illuminated by monochromatic light. Fringes formed on the screen held at a distance of 100 cm from the slits are 0.5 mm apart. What is the wavelength of light ?

(1) 100 Å (2) 350 Å (3) 500 Å (4) 5000 Å

45. A microstate is a configuration of :

(1) distinguishable particles within a given state

(2) indistinguishable particles within a given state

(3) random distribution

(4) non-random distribution

46. In a micro canonical ensemble, a system A of fixed volume is in contact with a large reservoir B. Then :

(1) A can exchange only energy with B

(2) A can exchange only particles with B

(3) A can exchange neither energy not particle with B

(4) A can exchange both energy and particle with B

47. The entropy for ten particles in a state with energy level occupations of (4, 3, 2, 1, 0) is equal to :

(1) $7.8\ J\ K^{-1}\ mol^{-1}$ (2) $2.45\ J\ K^{-1}\ mol^{-1}$

(3) $1.45\ J\ K^{-1}\ mol^{-1}$ (4) $4.34\ J\ K^{-1}\ mol^{-1}$

48. An object is at a temperature of 673 K. At what temperature would it radiate energy twice as fast ?

(1) 400 K (2) 550 K (3) 800 K (4) 1000 K

49. The number of electron states per electron volt at $E = E_F/2$ in a 1 g of sample of copper at 0 K is :

(1) 3.46×10^{22} states/eV (2) 5.46×10^{23} states/eV

(3) 1.43×10^{21} states/eV (4) 6.46×10^{20} states/eV

50. What is zero point energy ?

(1) The irremovable energy of a particle, corresponding to an excited state

(2) The irremovable energy of a particle, corresponding to the lowest energy state

(3) The removable energy of a particle, corresponding to and excited state

(4) The removable energy of a particle, corresponding to the lowest energy state

51. Bosons are particle with :

(1) integral spins

(2) half-integral spins

(3) does not obey the Fermi-Dirac statistics

(4) they possess conserved baryon or lepton quantum number

52. What is the limit of the molecular vibrational partition function as the temperature goes to zero ?

(1) infinity (2) zero (3) one (4) negative

53. Newton's ring illustrates the phenomenon of :

(1) interference (2) diffraction

(3) polarization (4) circularly polarized light

54. Which of the following phenomena produces the colours in the soap bubble ?

(1) diffraction (2) polarization (3) dispersion (4) interference

55. A transparent film of glass of refractive index 1.5 is introduced normally in the path of one of the interfering beams of Michelson's interferometer which is illuminated with light of wavelength 4800 Å. This causes 500 dark fringes to sweep across the field and the corresponding film thickness is :

(1) 1 μm (2) 240 μm (3) 0.5 mm (4) 0.01 mm

56. Maximum number of orders available with a grating is :

(1) independent of grating element

(2) directly proportional to grating element

(3) inversely proportional to grating element

(4) proportional to grating element

57. The condition for observing Fraunfoher diffraction from a single slit is that the light wave front incident on the slit should be :

(1) spherical (2) cylindrical (3) plane (4) elliptical

58. Which phenomenon causes the polarization of light ?

(1) reflection (2) double reflection

(3) double refraction (4) diffraction

59. Light wave are transverse in nature, can be demonstrated by observing the phenomenon of :

(1) dispersion (2) interference (3) polarization (4) diffraction

60. The indices of refraction for the ordinary and extra-ordinary rays are 1.586 and 1.592. The thickness of the mica sheet required for making a quarter wave plate for $\lambda = 5460$ Å would be :

(1) 0.02275 cm (2) 0.567 cm (3) 0.1 cm (4) 0.01 cm

61. One of the allotropy of carbon is graphite whose crystal structure is hexagonal. Let the lattice parameters for graphite be a = 2.451 Å; c = 6.701 Å and with density of 2.2589 g/cm^3. An estimated number of atoms in their unit cell :

(1) 4 (2) 6 (3) 8 (4) 12

62. The packing efficiency of diamond cubic unit cell is :

(1) 0.34 (2) 0.52 (3) 0.68 (4) 0.74

63. In ionic solid if the radius of anion is r_a and of cation is r_c, then bond length is :

(1) $(r_c + r_a)$ (2) $\sqrt{3}(r_c + r_a)$ (3) $\sqrt{3}/2(r_c + r_a)$ (4) $(r_c - r_a)$

64. The number of lattice points in the rhombohedral unit cell is :

(1) 1 (2) 2 (3) 4 (4) 8

65. The number of unit cells in 1 m^3 of FCC nickel (r_{Ni} = 1.243 Å) :

(1) 2.3×10^{28} (2) 3.3×10^{25} (3) 2.3×10^{38} (4) 12.3×10^{28}

66. If the first reflection from the FCC crystal has a Bragg angle θ of 21.5°, the second reflection will have an angle of θ of :

(1) 18.5° (2) 8.5° (3) 31.2° (4) 36.8°

67. If the interplanar spacing obtained from the second reflection of a diamond cubic crystal is 1.81 Å, the lattice parameter is :

(1) 0.905 Å (2) 2.56 Å (3) 3.62 Å (4) 5.12 Å

68. The discrete values of energy the atomic oscillator can have :

(1) $nh/2\pi\omega^2$ (2) $n^2h/2\pi\omega$ (3) $nh/2\pi\omega$ (4) $2nh/2\pi\omega$

69. If the Debye's temperature of metal is 450 K, the Debye's frequency is :

(1) 10^{13} Hz (2) 10^{15} Hz (3) 10^{23} Hz (4) 10 Hz

70. The classical value of molar specific heat is :

(1) $R_u/2$ (2) $3\,R_u$ (3) $3\,R_u/2$ (4) R_u

71. A surface of zinc having a work function of 4.3 eV is illuminated by light with a wavelength of 200 nm. The maximum kinetic energy of the emitted photoelectrons are :

(1) 1.9 eV (2) 6.2 eV (3) 5.7 eV (4) 0.58 keV

72. When the orbital quantum number l = 3, the magnetic quantum number takes the following number of values :

(1) 6 (2) 10 (3) 7 (4) 14

73. The total energy of the electron in hydrogen atom is :

(1) $-(13.6/n)$ eV (2) $(13.6/n)$ eV (3) $-(13.6/n^2)$ eV (4) $(13.6/n^2)$ eV

74. The maximum number of electrons in a sub-shell with orbital quantum number l is :

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

75. The position and momentum of a 1 keV electron are simultaneously determined. If its position is located within 1 Å, what is the percentage of uncertainty in its momentum ?

(1) 3.11 (2) 5.32 (3) 1.97 (4) 9.456

76. The de Broglie wavelength of a 10 eV electron is :

(1) 3.88×10^{-9} m (2) 3.88×10^{-10} m

(3) 6.88×10^{-10} m (4) 1.55×10^{-10} m

77. The work function of photoelectric material is 3.3 eV. The threshold frequency will be equal to :

(1) 8×10^{14} Hz (2) 8×10^{10} Hz (3) 5×10^{20} Hz (4) 2×10^{14} Hz

78. The energy levels of a particle that is confined within the infinite potential well :

(1) $\frac{h^2k^2}{8\pi^2m}$ (2) $\frac{h^2k^2}{4\pi m}$ (3) $\frac{hk}{4\pi m}$ (4) $\frac{hk^2}{8\pi m^2}$

79. The degeneracies of the lowest and the second lowest energy levels of a particle confined to two dimensional square well :

(1) 0 and 1 (2) 0 and 2 (3) 1 and 4 (4) 1 and 2

80. When an electron jumps from an orbit where n = 1 to n = 4, its energy in terms of the energy of the ground level (E_1) is :

(1) $E_1/9$ (2) $E_1/16$ (3) $2\,E_1$ (4) $16\,E_1$

81. According to Bohr's atomic model, the angular momentum of electron in n^{th} orbit is equal to an integral multiple of :

(1) $2h/\pi$ (2) $h/2\pi$ (3) h/π (4) $nh/2\pi$

82. How does the momentum of a photon change if the wavelength is halved ?

(1) Doubles (2) Quadruples (3) Stays the same (4) Is cut to one-half

83. Consider the two-level system with $E_1 = -13.6$ eV, $E_2 = -3.4$ eV and the coefficient $A_{21} = 6 \times 10^8\ S^{-1}$. The frequency of light emitted due to transition from E_2 and E_1 is :

(1) 8.2×10^{17} Hz (2) 4.5×10^{16} Hz (3) 2.5×10^{15} Hz (4) 6.5×10^{14} Hz

84. Which of the following colours is associated with the lowest temperature of a black body radiator ?

(1) Red (2) Blue (3) Green (4) Yellow

85. The Kα line of material has energy of 66 keV. What is the atomic number of the element ?

(1) 45 (2) 55 (3) 81 (4) 23

86. When a spectrometer whose resolution is 0.010 nm is used, the minimum magnetic field needed for the Zeeman effect to be observed in a spectral line of 400 nm wavelength :

(1) 1.34 T (2) 3.64 T (3) 12 T (4) 2.456 T

87. The aluminium atom has two 3s electrons and one 3p electron outside filled inner shells. What is the term symbol of its ground state ?

(1) $^3P_1$ (2) $2^2P_{5/2}$ (3) $^2P_{1/2}$ (4) $^2P_{3/2}$

88. Which of the following is used in atomic clocks ?

(1) Laser (2) Quartz (3) Maser (4) Helium

89. A solid-state laser emits radiation of wavelength of 6000 Å and the life time, $\tau_{sp} = 10^{-6}$ s. Assume that the refractive index of the medium is one and the coefficient of stimulated emission is :

(1) 1.3×10^{19} m/kg (2) 1.3×10^{19} m/g

(3) 6.6×10^{19} cm/kg (4) 6.6×10^{19} m/g

90. The following type of laser can be used for generation of laser pulse :

(1) Nd- YAG laser (2) Carbon dioxide laser

(3) Helium neon laser (4) Ruby laser

91. The atomic number of a nucleus is equal to the number of :

(1) electrons it contains (2) protons it contains

(3) neutrons it contains (4) nucleons it contains

92. The antiparticle of electron is :

(1) positron (2) proton (3) alpha particle (4) beta particle

93. The average life T and the decay constant λ of a radioactive nucleus are related as :

(1) $T\lambda = 1$ (2) $T = 0.693/\lambda$ (3) $T/\lambda = 1$ (4) $T = c/\lambda$

94. In nuclear reactions we have conservation of :

(1) mass only (2) energy only

(3) momentum only (4) all of the above

95. Which theory explains the attraction between protons and neutrons ?

(1) Quantum Chromodynamics (2) The Standard Model

(3) String Theory (4) The Grand Unified Theory

96. The process in which two nuclei join together to form a new nucleus is called :

(1) fission (2) fusion

(3) chain reaction (4) nuclear transformation

97. In a nuclear reactor the moderator is :

(1) uranium-234 (2) uranium-238 (3) cadmium (4) heavy water

98. For making an atom bomb we use the process called :

(1) fission (2) fusion (3) ionization (4) electrolysis

99. The energy released per fission of a $_{92}U^{235}$ nucleus is nearly :

(1) 200 eV (2) 20 eV (3) 200 MeV (4) 2000 eV

100. The decay of artificial radioactive isotopes is accompanied by the emission of :

(1) alpha particle (2) beta particle (3) positron (4) neutron

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   (1) positron (2) proton (3) alpha particle (4) beta particle

13. The average life T and the decay constant λ of a radioactive nucleus are related as :
   (1) $T\lambda = 1$ (2) $T = 0.693/\lambda$ (3) $T/\lambda = 1$ (4) $T = c/\lambda$

14. In nuclear reactions we have conservation of :
   (1) mass only
   (2) energy only
   (3) momentum only
   (4) all of the above

15. Which theory explains the attraction between protons and neutrons ?
   (1) Quantum Chromodynamics
   (2) The Standard Model
   (3) String Theory
   (4) The Grand Unified Theory

16. The process in which two nuclei join together to form a new nucleus is called :
   (1) fission
   (2) fusion
   (3) chain reaction
   (4) nuclear transformation

17. In a nuclear reactor the moderator is :
   (1) uranium-234 (2) uranium-238 (3) cadmium (4) heavy water

18. For making an atom bomb we use the process called :

(1) fission (2) fusion (3) ionization (4) electrolysis

19. The energy released per fission of a $_{92}U^{235}$ nucleus is nearly :

(1) 200 eV (2) 20 eV (3) 200 MeV (4) 2000 eV

20. The decay of artificial radioactive isotopes is accompanied by the emission of :

(1) alpha particle (2) beta particle

(3) positron (4) neutron

21. A surface of zinc having a work function of 4.3 eV is illuminated by light with a wavelength of 200 nm. The maximum kinetic energy of the emitted photoelectrons are :

(1) 1.9 eV (2) 6.2 eV (3) 5.7 eV (4) 0.58 keV

22. When the orbital quantum number $l = 3$, the magnetic quantum number takes the following number of values :

(1) 6 (2) 10 (3) 7 (4) 14

23. The total energy of the electron in hydrogen atom is :

(1) $-(13.6/n)$ eV (2) $(13.6/n)$ eV (3) $-(13.6/n^2)$ eV (4) $(13.6/n^2)$ eV

24. The maximum number of electrons in a sub-shell with orbital quantum number l is :

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

25. The position and momentum of a 1 keV electron are simultaneously determined. If its position is located within 1 Å, what is the percentage of uncertainty in its momentum ?

(1) 3.11 (2) 5.32 (3) 1.97 (4) 9.456

26. The de Broglie wavelength of a 10 eV electron is :

(1) 3.88×10^{-9} m (2) 3.88×10^{-10} m

(3) 6.88×10^{-10} m (4) 1.55×10^{-10} m

27. The work function of photoelectric material is 3.3 eV. The threshold frequency will be equal to :

(1) 8×10^{14} Hz (2) 8×10^{10} Hz (3) 5×10^{20} Hz (4) 2×10^{14} Hz

28. The energy levels of a particle that is confined within the infinite potential well :

(1) $\frac{h^2k^2}{8\pi^2m}$ (2) $\frac{h^2k^2}{4\pi m}$ (3) $\frac{hk}{4\pi m}$ (4) $\frac{hk^2}{8\pi m^2}$

29. The degeneracies of the lowest and the second lowest energy levels of a particle confined to two dimensional square well :

(1) 0 and 1 (2) 0 and 2 (3) 1 and 4 (4) 1 and 2

30. When an electron jumps from an orbit where n = 1 to n = 4, its energy in terms of the energy of the ground level (E_1) is :

(1) $E_1/9$ (2) $E_1/16$ (3) $2\,E_1$ (4) $16\,E_1$

31. Bosons are particle with :

(1) integral spins

(2) half-integral spins

(3) does not obey the Fermi-Dirac statistics

(4) they possess conserved baryon or lepton quantum number

32. What is the limit of the molecular vibrational partition function as the temperature goes to zero ?

(1) infinity (2) zero (3) one (4) negative

33. Newton's ring illustrates the phenomenon of :

(1) interference (2) diffraction

(3) polarization (4) circularly polarized light

34. Which of the following phenomena produces the colours in the soap bubble ?

(1) diffraction (2) polarization

(3) dispersion (4) interference

35. A transparent film of glass of refractive index 1.5 is introduced normally in the path of one of the interfering beams of Michelson's interferometer which is illuminated with light of wavelength 4800 Å. This causes 500 dark fringes to sweep across the field and the corresponding film thickness is :

(1) 1 μm (2) 240 μm (3) 0.5 mm (4) 0.01 mm

36. Maximum number of orders available with a grating is :

(1) independent of grating element

(2) directly proportional to grating element

(3) inversely proportional to grating element

(4) proportional to grating element

37. The condition for observing Fraunfoher diffraction from a single slit is that the light wave front incident on the slit should be :

(1) spherical (2) cylindrical (3) plane (4) elliptical

38. Which phenomenon causes the polarization of light ?

(1) reflection (2) double reflection

(3) double refraction (4) diffraction

39. Light wave are transverse in nature, can be demonstrated by observing the phenomenon of :

(1) dispersion (2) interference

(3) polarization (4) diffraction

40. The indices of refraction for the ordinary and extra-ordinary rays are 1.586 and 1.592. The thickness of the mica sheet required for making a quarter wave plate for $\lambda = 5460$ Å would be :

(1) 0.02275 cm (2) 0.567 cm (3) 0.1 cm (4) 0.01 cm

41. The type of flip-flop is used to store the data in registers :

(1) D flip-flop (2) RS flip-flop

(3) JK flip-flop (4) T flip-flop

42. The flash memories find application in :

(1) super computers (2) mainframe systems

(3) distributed system (4) portable devices

43. With an amount of 110 J of heat is added to a gaseous system, whose internal energy increases by 40 J. Then the amount of external work done is :

(1) 120 J (2) 60 J (3) 70 J (4) 30 J

44. In the Carnot engine when heat is taken from the source its temperature :

(1) remains constant (2) increases

(3) decreases (4) fluctuate

45. The entropy at absolute zero of system is :

(1) tends to increase (2) zero

(3) maximum (4) fluctuate

46. Maxwell's thermodynamic relations are valid for :

(1) closed system

(2) open system

(3) a thermodynamic system in equilibrium

(4) only reversible process

47. The standard Gibbs energy change accompanying a spontaneous process has what property ?

(1) is always larger than the internal energy change

(2) is greater than zero

(3) is less than or equal to zero

(4) it has no restrictions on its value

48. When the white light enters in a lens, it undergoes a change in :

(1) frequency (2) wavelength

(3) velocity (4) wavelength and velocity

49. A double convex air bubble in water will act like a :

(1) concave lens (2) convex lens

(3) plane glass (4) concave mirror

50. Two thin lenses are in contact and the focal length of the combination is 80 cm. If the focal length of one of the lenses be 20 cm, the power of the other lens is :

(1) 1.89 diopters (2) 6 diopters

(3) –1.4 diopters (4) –3.75 diopters

51. An electron has a rest mass of 9.11×10^{-31} kg when its velocity of 0.9c the speed of light, its mass will be :

(1) 10.5×10^{-31} kg (2) 64.4×10^{-31} kg

(3) 20.9×10^{-31} kg (4) 6.37×10^{-37} kg

52. A rod of length 2 m moves with a velocity of 10^8 m/s relative to an observer at rest on the earth. What is the apparent length of the rod appearing to observer ?

(1) 11.78 m (2) 8.34 m (3) 55.4 m (4) 1.885 m

53. The fraction of electrons excited across the energy gap in Germanium (Eg = 0.7 eV) at room temperature (300 K) is :

(1) 7×10^{-18} (2) 1.7×10^{-12} (3) 4×10^{-12} (4) 1.3×10^{-6}

54. The degeneracy of the quantum states with $(n_x^2 + n_y^2 + n_z^2) = 6$ is :

(1) 12 (2) 24 (3) 48 (4) 8

55. At 0 K, the probability of finding an electron at energy level E is unity, when :

(1) $E = E_F$ (2) $E > E_F$ (3) $E < E_F$ (4) $E >> E_F$

56. The reverse saturation current in a p-n diode :

(1) increases (2) decreases

(3) remains constant (4) oscillates

57. The phase difference between the input and output voltages of a transistor connected in common emitter arrangement is :

(1) 360° (2) 180° (3) 90° (4) 270°

58. The DC current gain of a common-base transistor is 0.956 and emitter current is 10 mA. The base current value is :

(1) 0.66 mA (2) 0.38 mA (3) 0.25 mA (4) 0.44 mA

59. The electrical power output of a photodiode is maximum when a :

(1) Small forward current flows through it, irrespective of the bias

(2) Small forward bias exists across it

(3) Large reverse bias exists across it

(4) Small reverse bias exists across it

60. A common-emitter transistor has a typical value of gain (β) as 50 and the collector current is 10 mA. The emitter current is :

(1) 10.2 mA (2) 45.8 mA (3) 22.4 mA (4) 12.5 mA

61. Chromatic aberration is the product of :

(1) dispersive power × focal length of red ray

(2) dispersive power × mean focal length

(3) 1/ dispersive power × mean focal length

(4) dispersive power × 1/ mean focal length

62. The phenomenon of interference is used to prove that light is :

(1) longitudinal (2) transverse

(3) stationary wave (4) quantized

63. Two waves having the intensities in the ratio of 9 : 1 produce interference. The ratio of maximum to minimum intensity is equal to :

(1) 10 : 8 (2) 9 : 1 (3) 4 : 1 (4) 2 : 1

64. Two straight and narrow parallel slits 1 mm apart are illuminated by monochromatic light. Fringes formed on the screen held at a distance of 100 cm from the slits are 0.5 mm apart. What is the wavelength of light ?

(1) 100 Å (2) 350 Å (3) 500 Å (4) 5000 Å

65. A microstate is a configuration of :

(1) distinguishable particles within a given state

(2) indistinguishable particles within a given state

(3) random distribution

(4) non-random distribution

66. In a micro canonical ensemble, a system A of fixed volume is in contact with a large reservoir B. Then :

(1) A can exchange only energy with B

(2) A can exchange only particles with B

(3) A can exchange neither energy not particle with B

(4) A can exchange both energy and particle with B

67. The entropy for ten particles in a state with energy level occupations of (4, 3, 2, 1, 0) is equal to :

(1) $7.8\ J\ K^{-1}\ mol^{-1}$ (2) $2.45\ J\ K^{-1}\ mol^{-1}$

(3) $1.45\ J\ K^{-1}\ mol^{-1}$ (4) $4.34\ J\ K^{-1}\ mol^{-1}$

68. An object is at a temperature of 673 K. At what temperature would it radiate energy twice as fast ?

(1) 400 K (2) 550 K (3) 800 K (4) 1000 K

69. The number of electron states per electron volt at $E = E_F/2$ in a 1 g of sample of copper at 0 K is :

(1) 3.46×10^{22} states/eV (2) 5.46×10^{23} states/eV

(3) 1.43×10^{21} states/eV (4) 6.46×10^{20} states/eV

70. What is zero point energy ?

(1) The irremovable energy of a particle, corresponding to an excited state

(2) The irremovable energy of a particle, corresponding to the lowest energy state

(3) The removable energy of a particle, corresponding to and excited state

(4) The removable energy of a particle, corresponding to the lowest energy state

71. One of the allotropy of carbon is graphite whose crystal structure is hexagonal. Let the lattice parameters for graphite be a = 2.451 Å; c = 6.701 Å and with density of 2.2589 g/cm^3. An estimated number of atoms in their unit cell :

(1) 4 (2) 6 (3) 8 (4) 12

72. The packing efficiency of diamond cubic unit cell is :

(1) 0.34 (2) 0.52 (3) 0.68 (4) 0.74

73. In ionic solid if the radius of anion is r_a and of cation is r_c, then bond length is :

(1) $(r_c + r_a)$ (2) $\sqrt{3}(r_c + r_a)$ (3) $\sqrt{3}/2(r_c + r_a)$ (4) $(r_c - r_a)$

74. The number of lattice points in the rhombohedral unit cell is :

(1) 1 (2) 2 (3) 4 (4) 8

75. The number of unit cells in 1 m^3 of FCC nickel (r_{Ni} = 1.243 Å) :

(1) 2.3×10^{28} (2) 3.3×10^{25} (3) 2.3×10^{38} (4) 12.3×10^{28}

76. If the first reflection from the FCC crystal has a Bragg angle θ of 21.5°, the second reflection will have an angle of θ of :

(1) 18.5° (2) 8.5° (3) 31.2° (4) 36.8°

77. If the interplanar spacing obtained from the second reflection of a diamond cubic crystal is 1.81 Å, the lattice parameter is :

(1) 0.905 Å (2) 2.56 Å (3) 3.62 Å (4) 5.12 Å

78. The discrete values of energy the atomic oscillator can have :

(1) $nh/2\pi\omega^2$ (2) $n^2h/2\pi\omega$ (3) $nh/2\pi\omega$ (4) $2nh/2\pi\omega$

79. If the Debye's temperature of metal is 450 K, the Debye's frequency is :

(1) 10^{13} Hz (2) 10^{15} Hz (3) 10^{23} Hz (4) 10 Hz

80. The classical value of molar specific heat is :

(1) $R_u/2$ (2) $3\,R_u$ (3) $3\,R_u/2$ (4) R_u

81. Two particles of rest mass m_0 approach each other with equal and opposite velocity v, in the laboratory frame. The total energy of one particle as measured in the rest frame of other is :

(1) $E = m_0c^2$ (2) $E = 2m_0c^2$

(3) $E = 3m_0c^2$ (4) $E = 1/2\,m_0c^2$

82. Two masses m_1 and m_2 connected by a spring of spring constant k rest on a frictionless surface. If the masses are pulled apart and let go, the time period of oscillation is :

(1) $T = 2\pi\sqrt{\frac{1}{k}\left(\frac{m_1m_2}{m_1+m_2}\right)}$ (2) $T = 2\pi\sqrt{k\left(\frac{m_1+m_2}{m_1m_2}\right)}$

(3) $T = 2\pi\sqrt{\frac{m_1}{k}}$ (4) $T = 2\pi\sqrt{\frac{m_2}{k}}$

83. A body moves a distance of 10 m along a straight line under the action of force of 5 Newton. If the work done is 25 J, the angle which the force makes with the direction of motion of the body is :

(1) 90° (2) 60° (3) 30° (4) 0°

84. A body of mass m slide down an inclined plane making an angle of 45° with the horizontal. If the coefficient of friction between the body and the plane be 0.3, the acceleration of the body is approximately equal to :

(1) 0.49 g (2) 0.25 g (3) 1.5 g (4) 2.5 g

85. An electron has mass of 9.11×10^{-31} kg. It revolves about the nucleus in a circular orbit of radius 5.29×10^{-11} m at a speed of 2.2×10^{6} m/s. The linear momentum of the electron in this system will be :

(1) 1.1×10^{34} kg-m/s^2 (2) 2.0×10^{-24} kg-m/s

(3) 1.1×10^{-24} kg-m/s^2 (4) 4.1×10^{-34} kg-m/s^2

86. The moment of inertia of the body does not depend upon :

(1) mass of the body

(2) the distribution of mass in the body

(3) angular velocity of the body

(4) the axis of the rotation of the body

87. A flywheel is a uniform disc of mass 72 kg and radius 50 cm. What is the kinetic energy when it is rotating at 70 rpm ?

(1) 241.8 J (2) 300 J (3) 134.6 J (4) 34.56 J

88. A particle moved from position $r_1 = 3i + 2j - 6k$ to position $r_2 = 4i + j + 3k$ N. What is the work done ?

(1) 1 J (2) 0.01 J (3) 10 J (4) 100 J

89. If $0.5i + 0.8j + ck$ is a unit vector. Then c is equal to :

(1) $\sqrt{0.89}$ (2) 0.2 (3) 0.3 (4) $\sqrt{0.11}$

90. The field due to an electric dipole at an axial point E_1, of the dipole and at a point on the perpendicular bisector of dipole E_2 are related as :

(1) $E_1 = E_2$ (2) $E_1 = 2E_2$ (3) $2E_1 = E_2$ (4) $E_1 = 4E_2$

91. According to Bohr's atomic model, the angular momentum of electron in n^{th} orbit is equal to an integral multiple of :

(1) $2h/\pi$ (2) $h/2\pi$ (3) h/π (4) $nh/2\pi$

92. How does the momentum of a photon change if the wavelength is halved ?

(1) Doubles (2) Quadruples

(3) Stays the same (4) Is cut to one-half

93. Consider the two-level system with $E_1 = -13.6$ eV, $E_2 = -3.4$ eV and the coefficient $A_{21} = 6 \times 10^8\ S^{-1}$. The frequency of light emitted due to transition from E_2 and E_1 is :

(1) 8.2×10^{17} Hz (2) 4.5×10^{16} Hz (3) 2.5×10^{15} Hz (4) 6.5×10^{14} Hz

94. Which of the following colours is associated with the lowest temperature of a black body radiator ?

(1) Red (2) Blue (3) Green (4) Yellow

95. The Kα line of material has energy of 66 keV. What is the atomic number of the element ?

(1) 45 (2) 55 (3) 81 (4) 23

96. When a spectrometer whose resolution is 0.010 nm is used, the minimum magnetic field needed for the Zeeman effect to be observed in a spectral line of 400 nm wavelength :

(1) 1.34 T (2) 3.64 T (3) 12 T (4) 2.456 T

97. The aluminium atom has two 3s electrons and one 3p electron outside filled inner shells. What is the term symbol of its ground state ?

(1) $^3P_1$ (2) $2^2P_{5/2}$ (3) $^2P_{1/2}$ (4) $^2P_{3/2}$

98. Which of the following is used in atomic clocks ?

(1) Laser (2) Quartz (3) Maser (4) Helium

99. A solid-state laser emits radiation of wavelength of 6000 Å and the life time, $\tau_{sp} = 10^{-6}$ s. Assume that the refractive index of the medium is one and the coefficient of stimulated emission is :

(1) 1.3×10^{19} m/kg (2) 1.3×10^{19} m/g

(3) 6.6×10^{19} cm/kg (4) 6.6×10^{19} m/g

100. The following type of laser can be used for generation of laser pulse :

(1) Nd- YAG laser (2) Carbon dioxide laser

(3) Helium neon laser (4) Ruby laser

Total No. of Printed Pages : 13

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CPG-EE-2018 (Physics)-(SET-Y)

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Time : **1½ Hours** Total Questions : **100** Max. Marks : **100**

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

Candidate's Name _____ Date of Birth _____

Father's Name _____ Mother's Name _____

Date of Exam : _____

_____ _____

(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/misbehaviour 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. In case there is any discrepancy in any question(s) in the Question Booklet, the same may be brought to the notice of the Controller of Examinations in writing ***within two hours*** after the test is over. No such complaint(s) will be entertained thereafter.
4. 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.
5. ***Use only black or blue ball point pen of good quality in the OMR Answer-Sheet.***
6. There will be ***negative*** marking. Each correct answer will be awarded ***one*** full mark and each incorrect answer will be negatively marked for which the candidate will get ¼ discredit. Cutting, erasing, overwriting and more than one answer in OMR Answer-Sheet will be treated as incorrect answer.
7. *Before answering the questions, the candidates should ensure that they have been supplied correct & complete question booklet. Complaints, if any, regarding misprinting etc. will not be entertained* **30** *minutes after starting of the examination.*

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1. Chromatic aberration is the product of :
   (1) dispersive power × focal length of red ray
   (2) dispersive power × mean focal length
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3. Two waves having the intensities in the ratio of 9 : 1 produce interference. The ratio of maximum to minimum intensity is equal to :
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(3) $T = 2\pi\sqrt{\frac{m_1}{k}}$ (4) $T = 2\pi\sqrt{\frac{m_2}{k}}$

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(2) the distribution of mass in the body

(3) angular velocity of the body

(4) the axis of the rotation of the body

27. A flywheel is a uniform disc of mass 72 kg and radius 50 cm. What is the kinetic energy when it is rotating at 70 rpm ?

(1) 241.8 J (2) 300 J (3) 134.6 J (4) 34.56 J

28. A particle moved from position $r_1 = 3i + 2j - 6k$ to position $r_2 = 4i + j + 3k$ N. What is the work done ?

(1) 1 J (2) 0.01 J (3) 10 J (4) 100 J

29. If $0.5i + 0.8j + ck$ is a unit vector. Then c is equal to :

(1) $\sqrt{0.89}$ (2) 0.2 (3) 0.3 (4) $\sqrt{0.11}$

30. The field due to an electric dipole at an axial point E_1, of the dipole and at a point on the perpendicular bisector of dipole E_2 are related as :

(1) $E_1 = E_2$ (2) $E_1 = 2E_2$ (3) $2E_1 = E_2$ (4) $E_1 = 4E_2$

31. The atomic number of a nucleus is equal to the number of :

(1) electrons it contains (2) protons it contains

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(1) $T\lambda = 1$ (2) $T = 0.693/\lambda$ (3) $T/\lambda = 1$ (4) $T = c/\lambda$

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(1) mass only (2) energy only

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49. If the Debye's temperature of metal is 450 K, the Debye's frequency is :

(1) 10^{13} Hz (2) 10^{15} Hz (3) 10^{23} Hz (4) 10 Hz

50. The classical value of molar specific heat is :

(1) $R_u/2$ (2) $3\ R_u$ (3) $3\ R_u/2$ (4) R_u

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68. The energy levels of a particle that is confined within the infinite potential well :

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69. The degeneracies of the lowest and the second lowest energy levels of a particle confined to two dimensional square well :

(1) 0 and 1 (2) 0 and 2 (3) 1 and 4 (4) 1 and 2

70. When an electron jumps from an orbit where n = 1 to n = 4, its energy in terms of the energy of the ground level (E_1) is :

(1) $E_1/9$ (2) $E_1/16$ (3) $2E_1$ (4) $16E_1$

71. According to Bohr's atomic model, the angular momentum of electron in n^{th} orbit is equal to an integral multiple of :

(1) $2h/\pi$ (2) $h/2\pi$ (3) h/π (4) $nh/2\pi$

72. How does the momentum of a photon change if the wavelength is halved ?

(1) Doubles (2) Quadruples

(3) Stays the same (4) Is cut to one-half

73. Consider the two-level system with $E_1 = -13.6$ eV, $E_2 = -3.4$ eV and the coefficient $A_{21} = 6 \times 10^8\ S^{-1}$. The frequency of light emitted due to transition from E_2 and E_1 is :

(1) 8.2×10^{17} Hz (2) 4.5×10^{16} Hz

(3) 2.5×10^{15} Hz (4) 6.5×10^{14} Hz

74. Which of the following colours is associated with the lowest temperature of a black body radiator ?

(1) Red (2) Blue (3) Green (4) Yellow

75. The Kα line of material has energy of 66 keV. What is the atomic number of the element ?

(1) 45 (2) 55 (3) 81 (4) 23

76. When a spectrometer whose resolution is 0.010 nm is used, the minimum magnetic field needed for the Zeeman effect to be observed in a spectral line of 400 nm wavelength :

(1) 1.34 T (2) 3.64 T (3) 12 T (4) 2.456 T

77. The aluminium atom has two 3s electrons and one 3p electron outside filled inner shells. What is the term symbol of its ground state ?

(1) $^3P_1$ (2) $2^2P_{5/2}$ (3) $^2P_{1/2}$ (4) $^2P_{3/2}$

78. Which of the following is used in atomic clocks ?

(1) Laser (2) Quartz (3) Maser (4) Helium

79. A solid-state laser emits radiation of wavelength of 6000 Å and the life time, $\tau_{sp} = 10^{-6}$ s. Assume that the refractive index of the medium is one and the coefficient of stimulated emission is :

(1) 1.3×10^{19} m/kg (2) 1.3×10^{19} m/g

(3) 6.6×10^{19} cm/kg (4) 6.6×10^{19} m/g

80. The following type of laser can be used for generation of laser pulse :

(1) Nd- YAG laser (2) Carbon dioxide laser

(3) Helium neon laser (4) Ruby laser

81. If the potential difference between two points 2 cm apart in an electric field of 20 V, the electric field intensity between these points will be around :

(1) 20 V/m (2) 40 V/m (3) 10 V/m (4) 10 V/cm

82. If a positive charge q moving with velocity, v through a point in a magnetic field experiences a deflecting force F, then the magnetic induction B at that point will depend upon :

(1) q (2) v (3) F (4) q, v, and F

83. The permeability of para and ferromagnetic materials are :

(1) greater than unity (2) less than unity

(3) equal to unity (4) negative

84. Poynting vector is expressed as :

(1) $(H \times E)$ (2) $(E \times H)$

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85. Young's modulus (Y), Modulus of rigidity (η) and Poisson ratio (σ) are related as :

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(3) $\frac{Y}{\eta} = 2(1+\sigma)$ (4) $2Y = \eta(1 + \sigma)$

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(1) P = 2/3 E (2) P = 3/2 E (3) P = 1/2 E (4) P = $\sqrt{3}$/2 E

88. The law of equipartition of energy was postulated by :

(1) Maxwell (2) Boltzman (3) Stefan (4) Weins

89. The viscosity of gas is directly proportional to :

(1) temperature (2) square root of temperature

(3) characteristic gas constant (4) density of gas

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(1) is an inertial frame by definition

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95. A transparent film of glass of refractive index 1.5 is introduced normally in the path of one of the interfering beams of Michelson's interferometer which is illuminated with light of wavelength 4800 Å. This causes 500 dark fringes to sweep across the field and the corresponding film thickness is :

(1) 1 μm (2) 240 μm (3) 0.5 mm (4) 0.01 mm

96. Maximum number of orders available with a grating is :

(1) independent of grating element

(2) directly proportional to grating element

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Total No. of Printed Pages : 13

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CPG-EE-2018 (Physics)-(SET-Y)

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Time : **1½ Hours** Total Questions : **100** Max. Marks : **100**

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

Candidate's Name _____ Date of Birth _____

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_____ _____

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

SEAL

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1. All questions are ***compulsory*** and carry equal marks. The candidates are required to attempt all questions.
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/misbehaviour 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. In case there is any discrepancy in any question(s) in the Question Booklet, the same may be brought to the notice of the Controller of Examinations in writing ***within two hours*** after the test is over. No such complaint(s) will be entertained thereafter.
4. 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.
5. ***Use only black or blue ball point pen of good quality in the OMR Answer-Sheet.***
6. There will be ***negative*** marking. Each correct answer will be awarded ***one*** full mark and each incorrect answer will be negatively marked for which the candidate will get ¼ discredit. Cutting, erasing, overwriting and more than one answer in OMR Answer-Sheet will be treated as incorrect answer.
7. *Before answering the questions, the candidates should ensure that they have been supplied correct & complete question booklet. Complaints, if any, regarding misprinting etc. will not be entertained* **30** *minutes after starting of the examination.*

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58. The discrete values of energy the atomic oscillator can have :

(1) $nh/2\pi\omega^2$ (2) $n^2h/2\pi\omega$ (3) $nh/2\pi\omega$ (4) $2nh/2\pi\omega$

59. If the Debye's temperature of metal is 450 K, the Debye's frequency is :

(1) 10^{13} Hz (2) 10^{15} Hz (3) 10^{23} Hz (4) 10 Hz

60. The classical value of molar specific heat is :

(1) $R_u/2$ (2) $3\,R_u$ (3) $3\,R_u/2$ (4) R_u

61. According to Bohr's atomic model, the angular momentum of electron in n^{th} orbit is equal to an integral multiple of :

(1) $2h/\pi$ (2) $h/2\pi$ (3) h/π (4) $nh/2\pi$

62. How does the momentum of a photon change if the wavelength is halved ?

(1) Doubles (2) Quadruples (3) Stays the same (4) Is cut to one-half

63. Consider the two-level system with $E_1 = -13.6$ eV, $E_2 = -3.4$ eV and the coefficient $A_{21} = 6 \times 10^8\ S^{-1}$. The frequency of light emitted due to transition from E_2 and E_1 is :

(1) 8.2×10^{17} Hz (2) 4.5×10^{16} Hz (3) 2.5×10^{15} Hz (4) 6.5×10^{14} Hz

64. Which of the following colours is associated with the lowest temperature of a black body radiator ?

(1) Red (2) Blue (3) Green (4) Yellow

65. The Kα line of material has energy of 66 keV. What is the atomic number of the element ?

(1) 45 (2) 55 (3) 81 (4) 23

66. When a spectrometer whose resolution is 0.010 nm is used, the minimum magnetic field needed for the Zeeman effect to be observed in a spectral line of 400 nm wavelength :

(1) 1.34 T (2) 3.64 T (3) 12 T (4) 2.456 T

67. The aluminium atom has two 3s electrons and one 3p electron outside filled inner shells. What is the term symbol of its ground state ?

(1) $^3P_1$ (2) $2^2P_{5/2}$ (3) $^2P_{1/2}$ (4) $^2P_{3/2}$

68. Which of the following is used in atomic clocks ?

(1) Laser (2) Quartz (3) Maser (4) Helium

69. A solid-state laser emits radiation of wavelength of 6000 Å and the life time, $\tau_{sp} = 10^{-6}$ s. Assume that the refractive index of the medium is one and the coefficient of stimulated emission is :

(1) 1.3×10^{19} m/kg (2) 1.3×10^{19} m/g

(3) 6.6×10^{19} cm/kg (4) 6.6×10^{19} m/g

70. The following type of laser can be used for generation of laser pulse :

(1) Nd- YAG laser (2) Carbon dioxide laser

(3) Helium neon laser (4) Ruby laser

71. Chromatic aberration is the product of :

(1) dispersive power × focal length of red ray

(2) dispersive power × mean focal length

(3) 1/ dispersive power × mean focal length

(4) dispersive power × 1/ mean focal length

72. The phenomenon of interference is used to prove that light is :

(1) longitudinal (2) transverse

(3) stationary wave (4) quantized

73. Two waves having the intensities in the ratio of 9 : 1 produce interference. The ratio of maximum to minimum intensity is equal to :

(1) 10 : 8 (2) 9 : 1 (3) 4 : 1 (4) 2 : 1

74. Two straight and narrow parallel slits 1 mm apart are illuminated by monochromatic light. Fringes formed on the screen held at a distance of 100 cm from the slits are 0.5 mm apart. What is the wavelength of light ?

(1) 100 Å (2) 350 Å (3) 500 Å (4) 5000 Å

75. A microstate is a configuration of :

(1) distinguishable particles within a given state

(2) indistinguishable particles within a given state

(3) random distribution

(4) non-random distribution

76. In a micro canonical ensemble, a system A of fixed volume is in contact with a large reservoir B. Then :

(1) A can exchange only energy with B

(2) A can exchange only particles with B

(3) A can exchange neither energy not particle with B

(4) A can exchange both energy and particle with B

77. The entropy for ten particles in a state with energy level occupations of (4, 3, 2, 1, 0) is equal to :

(1) $7.8\ J\ K^{-1}\ mol^{-1}$ (2) $2.45\ J\ K^{-1}\ mol^{-1}$

(3) $1.45\ J\ K^{-1}\ mol^{-1}$ (4) $4.34\ J\ K^{-1}\ mol^{-1}$

78. An object is at a temperature of 673 K. At what temperature would it radiate energy twice as fast ?

(1) 400 K (2) 550 K (3) 800 K (4) 1000 K

79. The number of electron states per electron volt at $E = E_F/2$ in a 1 g of sample of copper at 0 K is :

(1) 3.46×10^{22} states/eV (2) 5.46×10^{23} states/eV

(3) 1.43×10^{21} states/eV (4) 6.46×10^{20} states/eV

80. What is zero point energy ?

(1) The irremovable energy of a particle, corresponding to an excited state

(2) The irremovable energy of a particle, corresponding to the lowest energy state

(3) The removable energy of a particle, corresponding to and excited state

(4) The removable energy of a particle, corresponding to the lowest energy state

81. An electron has a rest mass of 9.11×10^{-31} kg when its velocity of 0.9c the speed of light, its mass will be :

(1) 10.5×10^{-31} kg (2) 64.4×10^{-31} kg

(3) 20.9×10^{-31} kg (4) 6.37×10^{-37} kg

82. A rod of length 2 m moves with a velocity of 10^8 m/s relative to an observer at rest on the earth. What is the apparent length of the rod appearing to observer ?

(1) 11.78 m (2) 8.34 m (3) 55.4 m (4) 1.885 m

83. The fraction of electrons excited across the energy gap in Germanium (Eg = 0.7 eV) at room temperature (300 K) is :

(1) 7×10^{-18} (2) 1.7×10^{-12}

(3) 4×10^{-12} (4) 1.3×10^{-6}

84. The degeneracy of the quantum states with $(n_x^2 + n_y^2 + n_z^2) = 6$ is :

(1) 12 (2) 24 (3) 48 (4) 8

85. At 0 K, the probability of finding an electron at energy level E is unity, when :

(1) $E = E_F$ (2) $E > E_F$ (3) $E < E_F$ (4) $E >> E_F$

86. The reverse saturation current in a p-n diode :

(1) increases (2) decreases

(3) remains constant (4) oscillates

87. The phase difference between the input and output voltages of a transistor connected in common emitter arrangement is :

(1) 360° (2) 180° (3) 90° (4) 270°

88. The DC current gain of a common-base transistor is 0.956 and emitter current is 10 mA. The base current value is :

(1) 0.66 mA (2) 0.38 mA (3) 0.25 mA (4) 0.44 mA

89. The electrical power output of a photodiode is maximum when a :

(1) Small forward current flows through it, irrespective of the bias

(2) Small forward bias exists across it

(3) Large reverse bias exists across it

(4) Small reverse bias exists across it

90. A common-emitter transistor has a typical value of gain (β) as 50 and the collector current is 10 mA. The emitter current is :

(1) 10.2 mA (2) 45.8 mA (3) 22.4 mA (4) 12.5 mA

91. Two particles of rest mass m_0 approach each other with equal and opposite velocity v, in the laboratory frame. The total energy of one particle as measured in the rest frame of other is :

(1) $E = m_0c^2$ (2) $E = 2m_0c^2$ (3) $E = 3m_0c^2$ (4) $E = 1/2m_0c^2$

92. Two masses m_1 and m_2 connected by a spring of spring constant k rest on a frictionless surface. If the masses are pulled apart and let go, the time period of oscillation is :

(1) $T = 2\pi\sqrt{\frac{1}{k}\left(\frac{m_1m_2}{m_1+m_2}\right)}$ (2) $T = 2\pi\sqrt{k\left(\frac{m_1+m_2}{m_1m_2}\right)}$

(3) $T = 2\pi\sqrt{\frac{m_1}{k}}$ (4) $T = 2\pi\sqrt{\frac{m_2}{k}}$

93. A body moves a distance of 10 m along a straight line under the action of force of 5 Newton. If the work done is 25 J, the angle which the force makes with the direction of motion of the body is :

(1) 90° (2) 60° (3) 30° (4) 0°

94. A body of mass m slide down an inclined plane making an angle of 45° with the horizontal. If the coefficient of friction between the body and the plane be 0.3, the acceleration of the body is approximately equal to :

(1) 0.49 g (2) 0.25 g (3) 1.5 g (4) 2.5 g

95. An electron has mass of 9.11×10^{-31} kg. It revolves about the nucleus in a circular orbit of radius 5.29×10^{-11} m at a speed of 2.2×10^{6} m/s. The linear momentum of the electron in this system will be :

(1) 1.1×10^{34} kg-m/s^2 (2) 2.0×10^{-24} kg-m/s

(3) 1.1×10^{-24} kg-m/s^2 (4) 4.1×10^{-34} kg-m/s^2

96. The moment of inertia of the body does not depend upon :

(1) mass of the body

(2) the distribution of mass in the body

(3) angular velocity of the body

(4) the axis of the rotation of the body

97. A flywheel is a uniform disc of mass 72 kg and radius 50 cm. What is the kinetic energy when it is rotating at 70 rpm ?

(1) 241.8 J (2) 300 J (3) 134.6 J (4) 34.56 J

98. A particle moved from position $r_1 = 3i + 2j - 6k$ to position $r_2 = 4i + j + 3k$ N. What is the work done ?

(1) 1 J (2) 0.01 J (3) 10 J (4) 100 J

99. If $0.5i + 0.8j + ck$ is a unit vector. Then c is equal to :

(1) $\sqrt{0.89}$ (2) 0.2 (3) 0.3 (4) $\sqrt{0.11}$

100. The field due to an electric dipole at an axial point E_1, of the dipole and at a point on the perpendicular bisector of dipole E_2 are related as :

(1) $E_1 = E_2$ (2) $E_1 = 2E_2$ (3) $2E_1 = E_2$ (4) $E_1 = 4E_2$

ANSWER KEY OF PHYSICS MDUCEE 2018

Q. No.	A	B	C	D
1	3	4	2	1
2	1	4	4	3
3	2	1	3	3
4	1	2	4	3
5	2	3	1	1
6	3	1	3	2
7	1	1	1	1
8	4	1	3	1
9	3	2	3	4
10	2	1	2	4
11	4	2	1	1
12	4	1	1	2
13	1	1	4	1
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30	1	4	2	4
31	1	1	2	4
32	4	2	1	4
33	3	1	1	1
34	1	4	4	2
35	2	2	1	3
36	3	2	2	1
37	3	3	4	1
38	4	3	1	1

ANSWER KEY OF PHYSICS MDUCEE 2018

Q. No.	A	B	C	D
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43	3	3	1	1
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73	3	1	3	3
74	3	1	1	4
75	1	1	3	1
76	2	3	1	3

ANSWER KEY OF PHYSICS MDUCEE 2018

Q. No.	A	B	C	D
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81	2	3	4	1
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100	3	4	1	2