1. A simple pendulum is taken inside a coal mine. Relative to the period of oscillation on the surface, the time period inside the mine

    (A)   remains the same
    (B)   decreases
    (C)   increases
    (D)   becomes infinite

2. The motion of a simple pendulum undergoing large oscillation can be described as

    (A)   harmonic, non-conservative
    (B)   harmonic, conservative
    (C)   anharmonic, non-conservative
    (D)   anharmonic, conservative

3. When a planet moves around the sun its

    (A)   Arial velocity is constant
    (B)   Linear velocity is constant
    (C)   Angular velocity is constant
    (D)   Velocity is constant

4. Which one of the following electromagnetic waves has the longest wavelength?

    (A)   X-rays
    (B)   visible light
    (C)   infrared
    (D)   radio waves

5. According to the principle of superposition of waves, when two waves superpose each other, algebraic addition takes place in

    (A)   wavelength
    (B)   intensity
    (C)   amplitude
    (D)   frequency

6. Good absorbers of heat are

   (A) highly polished
   (B) good emitters
   (C) poor emitters
   (D) insulators

7. A diatomic molecule has _____ degrees of freedom in general

   (A) three
   (B) four
   (C) five
   (D) six

8. A cubical steel block of side 10 cm having density 7.8 g/cm³ floats on mercury of density 13.6 g/cm³ with its side vertical. What length of the block is above the mercury?

   (A) 2.23 cm
   (B) 4.26 cm
   (C) 7.7 cm
   (D) 9.32 cm

9. The acceleration of a body revolving in a circle at uniform speed is

   (A) directed towards the centre
   (B) directed away from the centre
   (C) directed tangentially
   (D) zero

10. Which one of the following is not accelerated?

    (A) A rocket travelling from earth surface to sky
    (B) A stone in free fall
    (C) A tennis ball rebounding from the ground
    (D) A car in which engine thrust is equal to the friction

11. When a charge is given to a soap bubble, it shows _____ in size

    (A) decrease
    (B) increase
    (C) no change
    (D) infinity

12. Which one of the following is invariant under a Galilean transformation?

   (A) Force
   (B) Velocity
   (C) Momentum
   (D) Displacement

13. Two particles approach each other with different velocities. After collision, one of them is found to have momentum 'p' in their centre of mass frame. In the same reference frame, the other particle must have momentum,

   (A) zero
   (B) – p/2
   (C) – p
   (D) – 2p

14. A magnet of length 10 cm and pole strength 100 is placed with its axis making an angle of 30° with the direction of a uniform magnetic field of strength 0.4 CGS units. The moment of the couple on the magnet in CGS units is

   (A) 40
   (B) 80
   (C) 100
   (D) 200

15. Particles that travel at the speed of light are called

   (A) solitons
   (B) luxons
   (C) tachyons
   (D) exciton

16. If we neglect the effect of air resistance, then the shape of the curve described by a projectile thrown horizontally from the top of a 14th floor building will be a

   (A) straight line
   (B) parabola
   (C) circle
   (D) zigzag

17. The distance between two coherent sources is 0.2 mm and interference fringes pattern is observed on a screen of 80 cm from the sources. If the wavelength is 6000 Å, then how far is the second dark fringe from the central bright fringe?

    (A) 0.24 cm
    (B) 0.36 cm
    (C) 0.48 cm
    (D) 0.60 cm

18. A Schottky defect in a crystal is an example of

    (A) a missing atom
    (B) an extra atom
    (C) a colour centre
    (D) stacking fault

19. In Boolean algebra, A.Ā is equal to

    (A) A
    (B) Ā
    (C) 0
    (D) 1

20. To construct a two input OR gate, one need at least

    (A) one resistance and two capacitors
    (B) one resistance and two diodes
    (C) one diode and two resistances
    (D) one diode and one resistance

21. Electron is a

    (A) lepton
    (B) meson
    (C) baryon
    (D) muon

22. A stationary electric charge produces

    (A) magnetic field
    (B) electric field
    (C) both electric and magnetic fields
    (D) time varying electric field

23. How long will it take for a radioactive element having half-life of 0.693 years to decrease its 10% of radioactive material?

   (A) 2.303 years
   (B) 2.303 days
   (C) 2.303 minutes
   (D) 2.303 seconds

24. The potential of an anharmonic oscillator is

   (A) $x/2$
   (B) $x^2/2$
   (C) $x^3/3$
   (D) $x^4/4$

25. If the motion of a particle is described by the differential equation $d^2x/dt^2 + ax = 0$, then the force acting on the particle is

   (A) ax
   (B) $-ax$
   (C) a^2x^2
   (D) $1/ax$

26. For large value of x, the function $(1-x^2)/(x^2+1)$ can be approximated to

   (A) infinity
   (B) zero
   (C) -1
   (D) $+1$

27. The value of $(\sin x) / x$ for a small value of x is,

   (A) infinity
   (B) zero
   (C) -1
   (D) $+1$

28. A body acted upon by a constant force has a uniform

   (A) velocity
   (B) acceleration
   (C) speed
   (D) momentum

29. How many atoms per unit cell are in the fcc structure?

   (A) 2
   (B) 4
   (C) 6
   (D) 12

30. Transformers are used to

   (A) convert AC to DC
   (B) step up/down AC voltage
   (C) convert DC to AC
   (D) step up/down DC voltages

31. A source of wavelength 5896 Å is incident on a slit at a perpendicular distance of 3 mm from Lloyd's single mirror and the screen is placed at a distance of 120 cm from the source. The fringe width is

   (A) 0.059 cm
   (B) 0.0118 cm
   (C) 0.0236 cm
   (D) 0.0354 cm

32. A particle cannot travel with the speed of light because its mass will become

   (A) zero
   (B) infinite
   (C) large
   (D) small

33. Meissner effect is

   (A) splitting of spectral lines in an electric field
   (B) inelastic scattering of photons
   (C) exclusion of magnetic flux
   (D) tunneling of electrons

34. Josephson effect is

    (A) splitting of spectral lines in an electric field
    (B) inelastic scattering of photons
    (C) exclusion of magnetic flux
    (D) tunneling of electrons

35. The instrument useful for the measurement of the intensity of radiation is

    (A) tangent galvanometer
    (B) ammeter
    (C) actinometer
    (D) radiometer

36. The process of combination of a particle and an antiparticle and then its conversion to radiation is called as

    (A) fusion
    (B) emission
    (C) annealing
    (D) annihilation

37. A heavy pendulum that can be used to measure the velocity of a projectile is

    (A) simple pendulum
    (B) inverted pendulum
    (C) froude pendulum
    (D) ballistic pendulum

38. Total number of Bravais lattices in three dimension is

    (A) 4
    (B) 7
    (C) 14
    (D) 32

39. A negative electrode is called as

    (A) anode
    (B) cathode
    (C) base
    (D) emitter

40. A way of transfer of heat in which there is movement of the molecules of the liquid is

   (A) diffusion
   (B) convection
   (C) radiation
   (D) dispersion

41. The characteristic impedance (Z_c) of free space is

   (A) 377 ohm
   (B) $\dfrac{E}{H}$
   (C) $\sqrt{\dfrac{\mu_o}{\varepsilon_o}}$
   (D) All of the above

42. For a particle moving on a two dimensional plane, the number of components required to specify the state of the system is

   (A) 1
   (B) 2
   (C) 3
   (D) 4

43. One horse power is

   (A) 246 watts
   (B) 546 watts
   (C) 746 watts
   (D) 946 watts

44. In a sonometer, a wire of 1 meter long is stretched by a weight of 15 kg and it is in unison with a tuning fork of frequency 256. The mass of the wire is

   (A) 0.0056 g
   (B) 0.056 g
   (C) 0.56 g
   (D) 5.6 g

45. What is the lowest frequency emitted by a column of air enclosed in a tube of one metre long which is closed at one end? (Assume the velocity of sound in air as 340 metre per second.)

(A) 340 Hz
(B) 170 Hz
(C) 85 Hz
(D) 56 Hz

46. A magnetic pole of strength 10 CGS unit attracts another pole placed at a distance of 5 cm from it with a force of 2 dynes. The strength of the second pole in CGS units is

(A) 2
(B) 5
(C) 10
(D) 50

47. The following particles are moving with the same velocity. Which one will have the shortest wavelength?

(A) electron
(B) neutron
(C) neutrino
(D) proton

48. Which one of the following statements about the energy (E) in a quantum is true?

(A) varies directly with frequency
(B) varies inversely with frequency
(C) same for all frequencies
(D) not predictable

49. In quantum mechanics, the Schroedinger's approach requires

(A) integral and differential calculus
(B) matrix and vector algebra
(C) bra-ket notation
(D) differential calculus and algebra

50. The lowest energy of an electron confined to move in a one dimensional infinite potential well of width 0.5 Å is

   (A) 9.375 eV
   (B) 12.5.0 eV
   (C) 37.5 eV
   (D) 150.0 eV

51. The term "degeneracy" means that

    (A) one eigenvalue have more than one eigenfunction
    (B) one eignevalue have one eigenfunction only
    (C) one eignefunction have many eigenvalues
    (D) eigenfunction is zero for excited state

52. A cyclist measures the average speed v of his cycling by measuring the distance moved in a particular time. He measured the distance as $d = 120 \pm$ m and time as $t = 20.0 \pm 1.2$ s. What is the average speed v?

    (A) 6.0 m/s
    (B) 6.42m/s
    (C) 6.0±0.4 m/s
    (D) 6.0 ±0.2m/s

53. A constant voltage source will have

    (A) low internal resistance
    (B) zero internal resistance
    (C) infinite internal resistance
    (D) None of the above

54. What is the total current flowing through the battery in the circuit shown below?
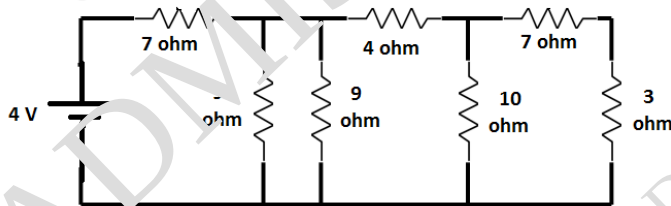
    (A) 2 A
    (B) 0.4 A
    (C) 4 A
    (D) 4.5 A

55. An object of height 5 cm is placed at 6 cm away from a lens of focal length 10 cm. Find the image distance and magnification.

(A) -15 cm, 2.5
(B) 15 cm, 2.5
(C) 30 cm, 5
(D) None of the above

56. Refractive index of glass is 1.5. Find the wavelength of a beam of light with a frequency of 10^{14} Hz in glass. (Assume velocity of light is 3×10^8 m/sec in vacuum.)

(A) 4 μm
(B) 2 μm
(C) 5 μm
(D) 8 μm

57. Light of wavelength λ and intensity I causes photo electric emission from a given surface with maximum kinetic energy K. If light of wavelength 0.8 λ and intensity **2I** is incident on the same photocathode, what will be the maximum kinetic energy of emitted electrons?

(A) K/0.8
(B) 0.8 K
(C) 2K/0.8 exactly
(D) more than K/0.8

58. A planet is moving around the Sun in a circular orbit of circumference C. The work done on the planet by the gravitational force F of the Sun is

(A) F/C
(B) FC/2
(C) FC
(D) zero

59. Of the following which is perfect diamagnetic?

(A) A super conductor below its critical temperature
(B) An antiferromagnet below its Neel temperature
(C) Spin glass
(D) A paramagnetic material at very low temperature

60. Below critical temperature, a superconductor has zero resistance. The charge carriers in this state are

   (A) mesons
   (B) fermions
   (C) electrons
   (D) bosons

61. A vector field is characterised by its

   (A) field intensity
   (B) flux density
   (C) potential
   (D) All of the above

62. Our understanding of red shift/ blue shift has brought us into new horizon of knowledge like

   (A) the universe is expanding
   (B) andromeda galaxy will collide with the Milky way in 3.75 billion years
   (C) most galaxies are moving away from us
   (D) All of the above

63. A charged particle q travels 0.1 meter in a uniform magnetic field of 2T and loses its energy by 100 keV. What is the work done by the magnetic field on the charge?

   (A) 200 keV
   (B) zero
   (C) −200 keV
   (D) 100 keV

64. Why is the cosmic background radiation so cool?

   (A) Interstellar dust grains absorbs and cools it.
   (B) Movement through it is so fast.
   (C) The expansion of the Universe has lengthened its wavelength.
   (D) It is emitted by cool stars.

65. _____ susceptibility is independent of temperature.

   (A) Paramagnetic
   (B) Ferromagnetic
   (C) Diamagnetic
   (D) Ferrimagnetic

66. If in the configuration space a system of particles need N coordinates, in the Phase Space representation, how many coordinates are needed to represent it?

   (A) N/2
   (B) 2N
   (C) ?
   (D) zero

67. The rate at which information can be carried through a communication channel depends on

   (A) carrier frequency alone
   (B) bandwidth
   (C) transmission loss
   (D) signal frequency

68. A geosynchronous satellite has

   (A) the same axial rotation period as that of the Earth
   (B) a circular orbit
   (C) a distance of 36000 km from Earth
   (D) All of the above

69. In the given voltage comparator circuit, what is the output waveform if we are inputting a sine wave at positive terminal of the op-amp.
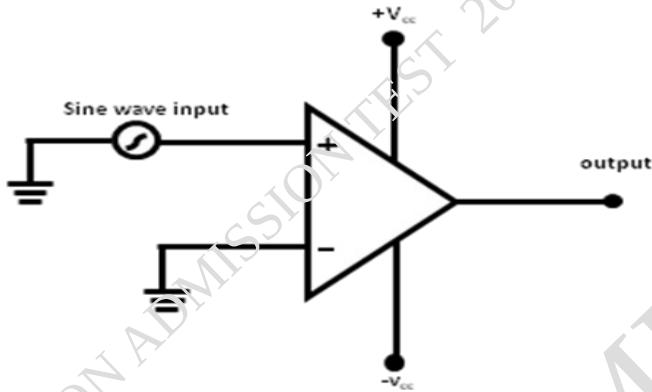
(A) amplified sine wave
(B) sine wave with different time period of the input
(C) saw tooth wave with same amplitude
(D) square wave with same time period of the input

70. Match the following

(a)	LED	1.	Stimulated emission
(b)	diode LASER	2.	Spontaneous emission
(c)	Solar Cell	3.	Light detector
(d)	Photo diode	4.	Power generation

(A) a-4, b-1, c-3, d-2
(B) a-1, b-2, c-3, d-4
(C) a-2, b-1, c-4, d-3
(D) a-2, b-1, c-3, d-4

71. Ripple factor is independent of the load for

(A) Capacitor filter
(B) Inductance filter
(C) Resistor-Capacitor filter
(D) LC filter

72. In all normal operations of a transistor, the emitter junction is ----------- biased and the collector junction is ----------- biased.

   (A) reverse, forward
   (B) forward, forward
   (C) forward, reverse
   (D) reverse, reverse

73. A state is denoted as $^4D_{5/2}$. What is the minimum number of electrons which could give rise to this state?

   (A) 1
   (B) 2
   (C) 3
   (D) 4

74. Hyperfine interaction appearing in the ESR spectra demonstrate that

   (A) molecule has orbital angular momentum
   (B) nucleus has spin angular momentum
   (C) electron has total angular momentum
   (D) nucleus always are spherical in shape

75. If the intensive property of a thermodynamic system is specific heat, the corresponding extensive property of the system is

   (A) entropy
   (B) surface tension
   (C) volume of the system
   (D) heat capacity of the system

76. A particle has position (x, y, z) and corresponding momenta (p_x, p_y, p_z). According to Heisenberg's Uncertainty principle, which of the following observables cannot be measured exactly at the same time?

   (A) x and p_x
   (B) x and p_y
   (C) p_y and p_z
   (D) x and z

77. Under the influence of a weak magnetic field (B), Normal Zemann effect might be exhibited by

    (A) Hydrogen (H)
    (B) Helium (He)
    (C) Magnesium (Mg)
    (D) Both (B) and (C)

78. Group velocity of matter waves is equal to the velocity of

    (A) sound waves
    (B) light waves
    (C) gamma rays
    (D) the moving particles

79. Geiger- Muller counter can

    (A) detect type of radiation
    (B) detect energy of radiation
    (C) only count the number of particles irrespective of the type of it
    (D) Both (A) and (B)

80. In β- decay, which of the following is not conserved?

    (A) total mass and energy
    (B) angular momentum
    (C) linear momentum
    (D) parity

81. Two mutually coherent waves of 600 nm light travel in the same direction to reach a point. In the second wave was delayed by a distance of 200 nm, the phase difference between them is

    (A) $2\frac{\pi}{3}$ radians
   (B) 360 degree
    (C) 0.67π radian
    (D) $\frac{2\pi}{3}$ radians

82. When unpolarized light falls on a glass plate at Brewster angle, the angle between the reflected and refracted rays is

(A) 60°
(B) 30°
(C) 90°
(D) 45°

83. Weidmann –Franz law is valid for

(A) Metals
(B) Insulators
(C) Semiconductors
(D) All materials

84. Temperature coefficient of resistance (TCR) curves for two semiconductors A and B are shown below. What is your conclusion?
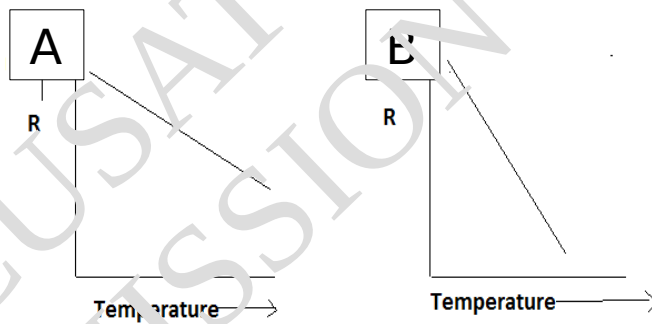
(A) Both have equal band gap
(B) A has higher band gap
(C) B has higher band gap
(D) Temperature coefficient of resistance is positive for both A and B

85. In case of friction between two bodies

(A) Rolling friction > static friction > kinetic friction
(B) Static friction > rolling friction > kinetic friction
(C) Rolling friction > kinetic friction > static friction
(D) Static friction > kinetic friction > rolling friction

86. Resistivity of metals becomes constant at very low temperature. This constant resistivity is called _____ and it indicates the _____ of metals.

    (A) residual resistivity, impurity
    (B) residual resistivity, hardness
    (C) phonon resistivity, purity
    (D) phonon resistivity, hardness

87. For an ideal gas the average velocity V_{ave}, most probable velocity V_{pro} and the RMS velocity V_{rms} are related as

    (A) $V_{ave} > V_{pro} > V_{rms}$
    (B) $V_{rms} > V_{ave} > V_{pro}$
    (C) $V_{rms} > V_{pro} > V_{ave}$
    (D) None of the above

88. A Gaussian surface 'S' is as shown in figure below and charge distribution in it and

    around are also shown. Gauss law is given as $\oint_s \bar{E}.ds = \dfrac{q}{\epsilon_0}$. In this equation
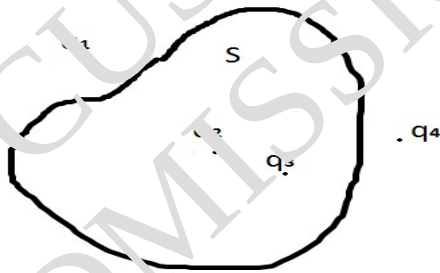
    (A) contribution to E is due to only charges q_2, q_3 and contribution to flux $\dfrac{q}{\epsilon_0}$ is due to all the charges, q_1, q_2, q_3, q_4

    (B) contribution to E is due to only charges q_2, q_3 and contribution to flux $\dfrac{q}{\epsilon_0}$ is also from the charges q_2, q_3 only

    (C) contribution to E is due to all the charges, q_1, q_2, q_3, q_4 but contribution to flux $\dfrac{q}{\epsilon_0}$ is only due to q_2, q_3.

    (D) contribution to E as well as to flux $\dfrac{q}{\epsilon_0}$ are constant respective of the charge distribution.

89. A cube of side L_0 moves with a velocity v parallel to one of its sides. Its volume as observed by a stationery observer, according to the theory of relativity, will be

(A) L_0^3

(B) $L_0^3 (1 - V^2/c^2)^3$

(C) $L_0^3 (1 - V^2/c^2)^{3/2}$

(D) $L_0^3 (1 - V^2/c^2)^{1/2}$

90. The equation, $Y(x,t) = A \sin(\omega t + kx)$ represents a

(A) transverse wave with wave length $\lambda = \dfrac{2\pi}{k}$ and progressing in the −ve x- direction

(B) transverse wave with wave length $\lambda = \dfrac{2\pi}{k}$ and progressing in the +ve X- direction

(C) longitudinal wave with wave length $\lambda = \dfrac{\pi}{k}$ and progressing in the −ve X- direction

(D) longitudinal wave with wave length $\lambda = \dfrac{2\pi}{k}$ and progressing in the +ve X- direction

91. What is the velocity of sound in a gas through which two waves of wave lengths 50 cm and 50.4 cm produce six beats?

(A) 30.3 m/s

(B) 405 m/s

(C) 303 m/s

(D) None of the above

92. Which of the following is not a fundamental particle?

(A) Electron

(B) Proton

(C) Photon

(D) Positron

93. Which of the following statements is not TRUE about γ-radiation?

(A) Excited nuclei emits γ-radiation and are electromagnetic waves

(B) It can penetrate several centimeters of lead

(C) It can be deflected by electric and magnetic fields

(D) It can ionize gases

94. The recoil momentum of an atom is P_A when it emits a photon of wavelength 1500 nm, and it is P_B when it emits a photon of visible wavelength 500 nm. The ratio $P_A:P_B$ is

(A) 1:1
(B) 1:3
(C) 3:1
(D) 3:2

95. An electron which is confined in the ground state in one dimensional box of width 10^{-10} m has energy = 38 eV. The energy of the electron in the first excited state is

(A) 152 eV
(B) 251 eV
(C) 51 eV
(D) 351 eV

96. Write down the Boolean expression for the logic circuit shown below.
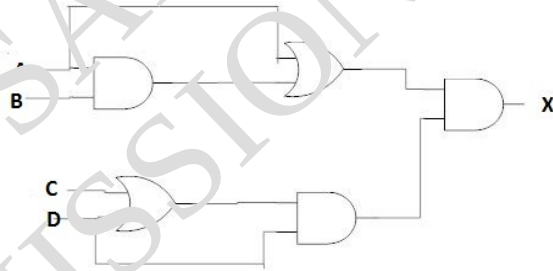
(A) $(AB + CD).CD = AB$
(B) $(AB + A).((C + D).D) = A.D$
(C) $(AB . CD) = A.D$
(D) None of the above

97. The binary coded decimal (BCD) equivalent of 429 is

(A) 01000010100
(B) 010001101001
(C) 110000101001
(D) 010000101001

98. The semi-empirical mass formula for the binding energy of the nucleus has surface correction term. This depends on the mass number A as

(A) $A^{-1/3}$
(B) $A^{1/3}$
(C) $A^{2/3}$
(D) A

99. A bulb contains one mole of hydrogen mixed with one mole of oxygen at temperature T. The ratio of 'rms' values of velocity of hydrogen molecules to that of oxygen molecules is

(A) 1:16
(B) 1:4
(C) 4:1
(D) 16:1

100. Resistivity of copper is lower than that of nickel. When a small percentage of copper is added to nickel, the resistivity of nickel

(A) increases
(B) decreases
(C) may increase or decrease
(D) remains the same

101. Schottky defects occur predominantly in

(A) covalent crystals
(B) ionic crystals
(C) molecular crystals
(D) polar crystals

102. Escape velocity of earth is 11.2 km/s, then the escape velocity of a planet with three times the earth's mass and having the same radius as that of the earth will be

(A) 19.4 km/s
(B) 33.6 km/s
(C) 6.6 km/s
(D) 22.4 km/s

103. In a thermodynamic process, which of the following is not a state function (a path independent function)?

   (A) Amount of heat(dQ)
   (B) Internal energy (dU)
   (C) Enthalpy (dH)
   (D) Entropy (dS)

104. A unit cell has anions (X) at the corners and also at the centers of the faces and cations (M) in the centre of each edge. The formula of the compound is

   (A) MX_2
   (B) MX_3
   (C) M_2X
   (D) M_3X_4

105. A plane intercepts the crystal axes 'a' at $0.25a$ and 'b' at $0.50b$. It is parallel to the third axis. Determine the Miller indices of the plane.

   (A) (312)
   (B) (210)
   (C) (212)
   (D) (110)

106. He^4 becomes a super fluid at 2.19 K but He^3 does not behave like a super fluid even down to 100 mK. Why?

   (A) He^3 is lighter than He^4
   (B) He^4 is bosonic in its electronic as well as nuclear structure. Hence Bose-Einstein condensation happens at 2.19 K , whereas He^3 is a Fermion and hence Bose condensation is not possible
   (C) zero point energy of He^3 is very large.
   (D) He^3 has higher critical temperature

107. If an observable has no explicit time dependence and it commutes with the Hamiltonian, then it is a quantum mechanical_____

   (A) fudge factor
   (B) dynamical variable
   (C) universal constant
   (D) constant of the motion

108. Ehrenfest's theorem partially shows the connection between quantum mechanics and

(A) classical mechanics
(B) quantum electrodynamics
(C) special relativity
(D) cosmology

109. Which of the following results is not equal to zero?

(A) Scalar triple product of three coplanar vectors
(B) Vector triple product of three non-coplanar vectors
(C) Curl of the gradient of electric potential
(D) Divergence of the curl of magnetic vector potential

110. On a horizontal frictionless surface, a 2 Kg mass **A** moving with speed 8.0 m/s strikes a 4.0 Kg mass **B** which is initially at rest. A gets deflected by 60° in its onward journey and moves with speed 4.0m/s after the collision. If ball B moves in the initial direction of A, then speed of **B** after collision is [assume that there is no external forces acting during or after the collision]

(A) 2.0 m/s
(B) 3.0 m/s
(C) 3.5 m/s
(D) 4.0 m/s

111. In quantum mechanics, the infinite square well corresponds to

(A) bound systems
(B) unbound systems
(C) isolated systems
(D) classical systems

112. Which of the following curves best represent growth of current in a series L-R circuit fed with a DC supply?
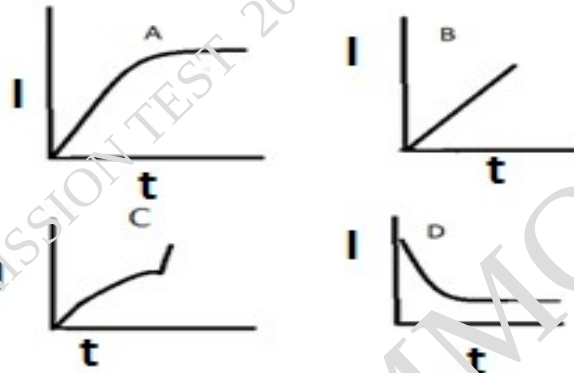
   (A) curve A
   (B) curve B
   (C) curve C
   (D) curve D

113. In an infinite square well potential, the wave function and its first spatial derivative are

   (A) both continuous at the boundaries
   (B) continuous and discontinuous at the boundaries, respectively
   (C) discontinuous and continuous at the boundaries, respectively
   (D) both discontinuous at the boundaries

114. The free particle system has

   (A) the simple harmonic oscillator potential (SHO)
   (B) an infinite square well potential
   (C) a finite square well potential
   (D) zero (or a constant) potential everywhere

115. The purpose of moderators in nuclear power reactors is to

   (A) thermalize the high energy neutrons
   (B) energize the neutrons
   (C) control the number of neutrons
   (D) absorb the neutrons

116. In a diffraction grating, the principal maxima are given by $d\sin\theta = n\lambda$. Here n is

   (A) the order of principal maxima
   (B) the number of wavelengths contained in the path difference between adjacent slits
   (C) slit width
   (D) Both (A) and (B)

117. If I_0 is the intensity of unpolarized light falling on a plane polarizer, intensity of transmitted beam will be

   (A) $I_0/2$, unpolarized
   (B) $I_0/2$, plane polarized
   (C) $I_0/4$, plane polarized
   (D) $I_0/2$, elliptically polarized

118. In a CRO while we change the time base, we are actually changing

   (A) the frequency of the saw tooth voltage applied to the X-plate
   (B) the amplitude of a square wave voltage applied to the X-plate
   (C) gain of the wave form applied to the Y-plate
   (D) the frequency of vertical amplitude

119. The Q factor of a coil in a resonant circuit is the measure of its

   (A) selectivity
   (B) retentivity
   (C) self inductance
   (D) mutual inductance

120. The proper life of pion (π^+) is 2.5×10^{-8} s. A beam of pions traveling with a speed of $0.9c$ in the laboratory frame, can travel a maximum distance of

   (A) 6.75 m
   (B) 15.49 m
   (C) 7.50 m
   (D) 17.10 m

121. An electron microscope can see finer structures than other microscopes because

    (A) electrons are very tiny particles.
    (B) the energy of the electrons is relatively low.
    (C) the electrons have a relatively small de Broglie wavelength.
    (D) the electrons have a relatively large de Broglie wavelength.

122. A spaceship moves towards you at 0.4c, where c is the speed of light. From the spaceship a red laser beam of perfect coherence is emitted in your direction. As measured in your frame of reference, the speed of the laser beam emitted by the spaceship is

    (A) 4/3c
    (B) c
    (C) 2/3c
    (D) 1/3c

123. In which of the following expressions, the force F is not conservative?

    (A) $\nabla.F = 0$
    (B) $\nabla xF = 0$
    (C) $\oint F. dl = 0$
    (D) $F = -\nabla V$ [V is some potential function]

124. In a fast breeder reactor,

    (A) heavy water is used as a moderator
    (B) graphite is used as a moderator
    (C) no moderator is used
    (D) beryllium is used as a moderator

125. Fermi-Dirac distribution at different temperatures is shown below. The temperatures T1 is at
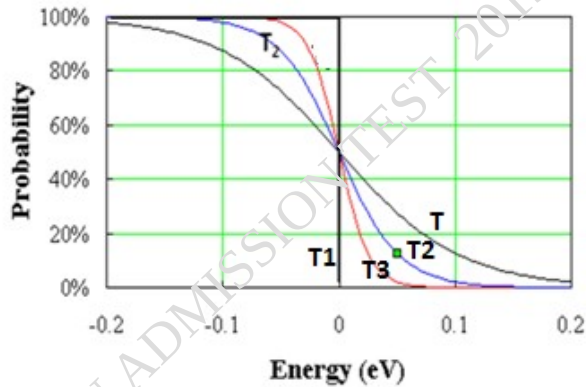
(A) 0K   and T3 > T2 > T
(B) 0K   and T > T2 > T3
(C) 273K and T > T2 > T3
(D) 273K and T3 > T2 > T

126. The relation between Fermi energy and electron density n is

(A) $E_F \propto n^{3/2}$
(B) $E_F \propto n^{2/3}$
(C) $E_F \propto n^{1/2}$
(D) $E_F \propto n^{1/3}$

127. If we double the temperature of an ideal gas, then average kinetic energy of its molecules will be

(A) half
(B) triple
(C) four times
(D) doubled

128. To a pure intrinsic semiconductor with band gap of 2eV, 10^{16} pentavalent impurities are added. The impurity level is 0.8 eV below the bottom of the conduction band. The electron concentration in the conduction band of the doped semiconductor at room temperature will be

   (A) $10^{16}/cm^3$
   (B) $10^{18}/cm^3$
   (C) zero
   (D) almost the intrinsic charge density n_i

129. Maximum power from a source is transferred to a load when the load resistance is _____ the source resistance.

   (A) greater than
   (B) less than
   (C) equal to
   (D) independent of

130. When an ac power is applied to a reactive load, then the voltage is

   (A) in phase with the current
   (B) 90 degree out of phase with the current
   (C) 180 degree out of phase with the current
   (D) 270 degree out of phase with the current

131. In negative feedback amplifiers, only_____ remains constant.

   (A) gain
   (B) bandwidth
   (C) gain-bandwidth product
   (D) distortion

132. If the uncertainty in the location (position) of a particle is equal to its de Broglie wavelength, the uncertainty in its velocity will be equal to

   (A) twice its velocity
   (B) half its velocity
   (C) its velocity
   (D) None of the above

133. An operational amplifier can be considered as a nearly perfect _____ amplifier with very large _____ value.

 (A) integrator, gain
 (B) differentiator, gain
 (C) noise resistant, gain
 (D) differential, CMRR

134. The glancing angle through which an X-ray beam of wave length $\lambda = 0.710$ A° will be reflected strongly in second order from the face (110) of a cubic crystal of rock salt with a = 2.828A°

 (A) 14°32⊞
 (B) 07.21°
 (C) 20°48⊞
 (D) 24.80°

135. Hard ferromagnetic materials have

 (A) high coercitivity
 (B) high retentivity
 (C) large hysteresis loop
 (D) All of the above

136. More than one, linearly independent eigen functions of a quantum mechanical system are found to belong to the same energy eigen value E. Such an energy eigen value E is said to be

 (A) orthogonal
 (B) orthogonal and degenerate
 (C) degenerate
 (D) non degenerate

137. The differential equation $m\frac{d^2 x}{dt^2}+r\frac{dx}{dt}+Kx=0$, describes the motion of a particle of mass m in a resistive medium. Such a motion is

 (A) simple harmonic motion
 (B) damped harmonic motion
 (C) undamped motion
 (D) forced oscillations

138. A ring of radius R, made up of non-conducting material is given a charge q uniformly distributed all over its circumference. In the circular region of radius r at the centre of the ring, a magnetic field B perpendicular to the plane of the ring varies at a constant rate $\frac{dB}{dt} = \beta$. Torque acting on the charged ring is

(A) $\frac{1}{2} q r^2 \beta$

(B) $\frac{1}{2} q R^2 \beta$

(C) $\frac{1}{2} \frac{q r^4}{R^2} \beta$

(D) Zero

139. When a slab of dielectric material is placed in an external electric field, which of the following statements is not correct?

(A) All its atoms get polarised
(B) Polarization charge appears on its surfaces perpendicular to the field direction
(C) The electric field gets modified inside the dielectric material
(D) Gauss's law cannot be applied to this situation for the polarization charge

140. In order to account for relativistic variation of mass at high energies, the resonance frequency in a synchrotron (synchrocyclotron) is adjusted by

(A) adjusting the orbit radius
(B) varying the magnetic field at the orbit
(C) modulating the frequency of dee voltage during the acceleration period
(D) All of the above

141. The displacement current in an electric circuit containing a capacitor is expressed as

(A) $\mu_o \varepsilon_o \frac{\partial \phi}{\partial t}$

(B) $\varepsilon_o \frac{\partial E}{\partial t}$

(C) $\varepsilon_o \frac{\partial \phi}{\partial t}$

(D) $\mu_o \varepsilon_o \frac{\partial E}{\partial t}$

142. A: A transformer cannot be used to step up or step down DC voltages
R: Only time varying magnetic flux linked with the circuit can cause Electromagnetic induction

(A) A and R are both wrong
(B) A is wrong but R is correct
(C) A is correct and it follows from R
(D) A is correct but does not follow from R

143. In Young's double slit experiment with helium-neon laser beam (wavelength 632 nm), the first interference minimum will occur at a path difference of

(A) 948 nm
(B) 316 nm
(C) 632 nm
(D) 258 nm

144. Diffraction grating, astronomical telescope and microscope give us --------resolutions respectively

(A) spatial, angular and spectral
(B) spectral, angular and spatial
(C) angular, spectral and spatial
(D) spectral, spatial and angular

145. The voltage gain in a RC coupled two stage transistor amplifier

(A) increases with frequency
(B) remains constant over entire frequency range
(C) remains constant in the intermediate frequency-range
(D) decreases with frequency continuously

146. The kinetic energy (E) of a non relativistic proton equals the energy of a photon of wave length λ_1. If λ_2 be the de Broglie wave length of the proton, then the ratio $\dfrac{\lambda_2}{\lambda_1}$ is proportional to

  (A) E

  (B) $\sqrt{E}$

  (C) $\sqrt{\dfrac{1}{E}}$

  (D) $\dfrac{1}{E}$

147. A diatomic molecule Hcl has characteristic vibrational frequency. The hydrogen atom is now replaced by deuterium, the corresponding frequency is ω_D. Then

  (A) $\omega_D = \omega_H$

  (B) $\omega_D > \omega_H$

  (C) $\omega_H > \omega_D$

  (D) Can't be determined

148. If potential for a particle is r^2 where 'a' is a positive constant and 'r' is the distance of the particle from the origin, then

  (A) all orbits are bounded
  (B) the particle is a free particle
  (C) all orbits are circular
  (D) None of the above

149. A small bar magnet is allowed to fall freely through a seamless metal tube held vertical. During fall its acceleration will be

  (A) equal to g
  (B) greater than g
  (C) less than g
  (D) zero

150. Which of the following does not represent the equation $y = y_0 e^{-bt}$?

(A) Radioactive decay
(B) Discharging of a charged capacitor through a resistor
(C) Attenuation of radiation in matter
(D) Growth of current in an LR circuit

PHYSICS PG - ANSWER KEY

TEST CODE: 613

QN. NO.	KEY	QN. NO.	KEY	QN. NO.	KEY	QN. NO.	KEY	QN. NO.	KEY
1	C	26	C	51	A	76	A	101	B
2	D	27	D	52	C	77	D	102	A
3	A	28	B	53	B	78	D	103	A
4	D	29	B	54	B	79	C	104	D
5	C	30	B	55	A	80	D	105	B
6	B	31	B	56	B	81	C	106	B
7	C	32	B	57	D	82	C	107	D
8	B	33	C	58	D	83	A	108	A
9	A	34	D	59	A	84	B	109	B
10	D	35	C	60	D	85	D	110	B
11	B	36	D	61	D	86	A	111	A
12	A	37	D	62	D	87	B	112	A
13	C	38	C	63	B	88	C	113	D
14	D	39	B	64	C	89	D	114	D
15	B	40	B	65	C	90	A	115	A
16	B	41	D	66	B	91	C	116	D
17	C	42	D	67	B	92	B	117	B
18	A	43	C	68	D	93	C	118	A
19	C	44	C	69	D	94	B	119	A
20	B	45	C	70	C	95	A	120	B
21	A	46	B	71	D	96	B	121	C
22	B	47	B	72	C	97	D	122	B
23	A	48	A	73	C	98	C	123	A
24	C	49	A	74	B	99	C	124	C
25	B	50	D	75	D	100	A	125	B

QN. NO.	KEY
126	B
127	D
128	D
129	C
130	B
131	C
132	C
133	D
134	C
135	D
136	C
137	B
138	B
139	D
140	C
141	C
142	C
143	B
144	B
145	C
146	B
147	C
148	A
149	C
150	D