613-PHYSICS
(FINAL)

1. If A is the amplitude of an oscillation, the distance moved by the particle in simple harmonic motion in one time period is

   (A) A
   (B) $2A$
   (C) Zero
   (D) $4A$

2. Differential form of Faraday law is

   (A) $\nabla \cdot \vec{E} = 0$

   (B) $\nabla \times \vec{E} = 0$

   (C) $\nabla \cdot \vec{E} = \rho$

   (D) $\nabla \times \vec{E} = -\frac{\partial \vec{B}}{\partial t}$

3. A parallel plate capacitor has plates of area A and separation d. It is charged to a potential difference V and the charging battery is then disconnected. The plates are pushed closer until their separation is $d/2$. The ratio of final stored energy to initial stored energy by the capacitor is

   (A) 1/2
   (B) 1/8
   (C) 1
   (D) 2

4. The magnetic potential energy stored in a certain inductor is 25 mJ, when the current in the inductor is 60 mA. This inductor is of inductance

   (A) 13.89 H
   (B) 138.88 H
   (C) 0.138 H
   (D) 1.389 H

5. Poynting vector of a plane electromagnetic wave propagating in the direction $\hat{k}$ is

(A) perpendicular to $\hat{k}$
(B) parallel to $\hat{k}$
(C) antiparallel to $\hat{k}$
(D) at an angle $\pi/4$ to $\hat{k}$

6. When the source and the listener move in the same direction with a speed equal to the half of the speed of sound, the change in frequency of the sound is

(A) Zero
(B) 25%
(C) 50%
(D) 75%

7. The time of reverberation of an empty auditorium is *T*. The time of reverberation of the auditorium with curtains and floor mates will be

(A) More than *T*
(B) Less than *T*
(C) Zero
(D) Same as *T*

8. In normal Zeeman Effect, the spectral line of an atom in a magnetic field is spilt into

(A) 2 component lines
(B) 3 component lines
(C) 4 component lines
(D) more than 4 component lines

9. Which one of the following molecules does **NOT** exhibit Infrared spectrum?

(A) H_2
(B) NO
(C) HCl
(D) CO

10. The selection rule for Stokes and Anti-Stokes rotational Raman transitions in a molecule is given by (J is rotational quantum number)

(A) $\Delta J = 0$
(B) $\Delta J = \pm 1$
(C) $\Delta J = \pm 2$
(D) $\Delta J = \pm 3$

11. A state of two electrons (1 and 2) each with spin $s = ½$ and $M_S = 1$ is represented by

(A) $\alpha(1)\beta(2)$
(B) $\alpha(1)\alpha(2)$
(C) $\beta(1)\alpha(2)$
(D) $\beta(1)\beta(2)$

12. Heisenberg Uncertainty principle is given by

(A) $\Delta E \cdot \Delta x \geq \frac{h}{2\pi}$

(B) $\Delta E \cdot \Delta t \geq \frac{h}{4\pi}$

(C) $\Delta p \cdot \Delta t \geq \frac{h}{4\pi}$

(D) $\Delta x \cdot \Delta t \geq \frac{h}{4\pi}$

13. Two particles are said to be distinguishable when

(A) the average distance between them is large compared to their de Broglie wavelength
(B) the average distance between them is small compared to their de Broglie wavelength
(C) they have overlapping wave packets
(D) their total wave function is symmetric under particle exchange

14. Davidson and Germer's experiment demonstrates the

(A) Polarization of light
(B) Quantization of angular momentum
(C) Diffraction of electrons
(D) Constancy of the velocity of light in vacuum

15. Light emission from ordinary optical sources is incoherent because

(A) Emission is predominantly spontaneous
(B) Emission is predominantly stimulated
(C) Emission occurs at several wavelengths
(D) Emission occurs with low intensity

16. The coherence length of a laser beam having a coherence time of 0.33 ms is about

(A) 33 km
(B) 100 km
(C) 3000 km
(D) 3.3 km

17. Energy states having a mean life-time of 10^{-3} s are known as

(A) Stable states
(B) Stationary states
(C) Metastable states
(D) Virtual states

18. The following four wires of length L and radius r are made of the same material. Which one of these will have the largest extension, when the same tension is applied?

(A) $L = 50$ cm, $r = 0.25$ mm
(B) $L = 100$ cm, $r = 0.5$ mm
(C) $L = 200$ cm, $r = 1$ mm
(D) $L = 300$ cm, $r = 1.5$ mm

19. A single crystal does not have a 5-fold symmetry because

(A) it violates translational symmetry of the crystal
(B) it violates orientational symmetry of the crystal
(C) it is energetically unfavourable
(D) None of the above

20. In a p-type semiconductor, the Fermi level E_F

(A) is located in the middle of the forbidden gap
(B) lies close to donor levels near the conduction band
(C) lies close to acceptor levels near the valance band
(D) does not exist at all

21. Quantum of lattice vibrational energy is known as

(A) photon
(B) polaron
(C) phonon
(D) vibron

22. The input signal given to a CE amplifier having a voltage gain of 150 is $V_i = 2 \cos (15t + \pi/3)$. The corresponding output signal will be

(A) $300 \cos (15t + 4\pi/3)$
(B) $300 \cos (15t + \pi/3)$
(C) $75 \cos (15t + 2\pi/3)$
(D) $2 \cos (15t + 5\pi/6)$

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23. In a p-type semiconductor, the minority carriers are

(A) holes
(B) electrons
(C) impurity atoms
(D) phonons

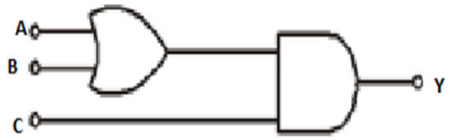
24. The ripple factor of a full wave rectifier is

(A) 1.21
(B) 1
(C) 0
(D) 0.482

25. The thermal voltage associated with a *pn*-junction is given by (q is the electronic charge)

(A) $\frac{kT}{q}$
(B) $\frac{kT^2}{q}$
(C) kT
(D) qkT

26. In the following circuit, to get an output 1, the choice for the input is



(A) A = 0, B = 1, C = 0
(B) A = 1, B = 0, C = 0
(C) A = 1, B = 1, C = 0
(D) A = 1, B = 0, C = 1

27. A satellite S is moving in an elliptical orbit around the earth. The mass of the satellite is very small compared to the mass of the earth. Then

(A) The acceleration of S is always directed towards the centre of the earth
(B) The angular momentum of S about the centre of the earth changes in direction, but its magnitude remains constant
(C) The total mechanical energy of S varies periodically with time
(D) The linear momentum of S remains constant is magnitude

28. The luminosity of a main sequence star is proportional to its mass (M) as

(A) $M^{½}$
(B) $M^{2.5}$
(C) $M^{3.5}$
(D) $M^{4.5}$

29. The two nearest harmonics of a tube closed at one end and open at other end are 220 Hz and 260 Hz. What is the fundamental frequency of the system?

(A) 10 Hz
(B) 20 Hz
(C) 30 Hz
(D) 40 Hz

30. Which one of the following is **NOT** an exact differential?

(A) dQ (Q = heat absorbed or released)
(B) dU (U = internal energy)
(C) dS (S = entropy)
(D) dF (F = free energy)

31. A black body is at a temperature of 5760 K. The energy of radiation emitted by the body at wavelength 250 nm is U_1 and at wavelength 500 nm is U_2. If the value of Wien's constant b is 2.88×10^6 nmK, which of the following is correct?

(A) $U_1 = U_2$

(B) $U_1 = U_2 = 0$

(C) $U_1 > U_2$

(D) $U_2 > U_1$

32. On increasing the number of electrons striking the anode of an X-ray tube, which of the following characteristics of X-rays increase?

(A) Frequency
(B) Wavelength
(C) Intensity
(D) Quality

33. Which of the following shows particle nature of light?

(A) Photoelectric effect
(B) Interference
(C) Polarization
(D) Refraction

34. The energy states occupied by the valence electron is called

(A) Indirect band
(B) Fermi level
(C) Conduction band
(D) Valence band

35. For which of the following the magnetic susceptibility is negative?

(A) Paramagnetic and ferromagnetic materials
(B) Paramagnetic materials only
(C) Ferromagnetic materials only
(D) Diamagnetic materials

36. The transition temperature below which a paramagnetic substance gets converted into a ferromagnetic substance is called the

(A) Curie point
(B) Neel point
(C) Knee point
(D) Saturation point

37. Pumping source preferred for gaseous lasers is

(A) Optical pumping
(B) Electrical pumping
(C) Chemical pumping
(D) X-Ray pumping

38. The expression for the coherence length is given by

(A) $\frac{c^2}{\Delta\omega}$

(B) $\frac{\Delta\omega}{c}$

(C) $\frac{c}{\Delta\omega}$

(D) $\frac{c^3}{\Delta\omega}$

39. Which of the following element occurs abundantly in universe?

(A) Hydrogen
(B) Nitrogen
(C) Oxygen
(D) Helium

40. The universe is inferred to be expanding because distant galaxies appear to

(A) Be growing in size
(B) Be made of dark matter
(C) Be moving away from earth
(D) Rotate rapidly

41. The point in space directly over your head is called

(A) The north star
(B) The meridian
(C) The zenith
(D) The celestial pole

42. Surface temperature of the sun is

(A) 48278 K
(B) 1712 K
(C) 25071 K
(D) 5778 K

43. A flow of plasma outward from the sun into interplanetary space is the

(A) Heliosphere
(B) Corona
(C) Photosphere
(D) Solar wind

44. A location on the earth's surface is described by stating its

(A) Meridian and longitude
(B) Latitude and longitude
(C) Latitude and direction
(D) Altitude and direction (or azimuth)

45. The density of free electron states in a metal

(A) varies as $E^{\frac{1}{2}}$
(B) varies as $E^{-\frac{1}{2}}$
(C) varies as E
(D) varies as $\frac{1}{E}$

46. All dielectric crystals which lack centre of symmetry are

(A) Ferroelectric
(B) Piezoelectric
(C) Paraelectric
(D) Pyroelectric

47. On increasing the dopant concentration, the width of the depletion region

(A) Decreases
(B) Increases
(C) Remains the same
(D) Will vanish

48. Among the following materials, which one has the highest hardness?

(A) Silicon Carbide
(B) Copper
(C) Steel
(D) Cast Iron

49. The energy gap (eV) in Si and Ge are

(A) 0.66 and 1.12
(B) 0.56 and 0.7
(C) 1.12 and 0.66
(D) 0.7 and 0.56

50. Which of the following bond is directional?

(A) Ionic
(B) Metallic
(C) Covalent
(D) van der Waals

51. In indirect bandgap semiconductor, the maximum of the valance band and the minimum of the conduction band lies at

(A) Same *k* values
(B) Different *k* values
(C) Overlapping *k* values
(D) Fermi level

52. Which of the following is non-renewable energy source?

(A) Geothermal energy
(B) Natural gas energy
(C) Biomass energy
(D) Solar energy

53. Fuel cell converts …….. into electrical energy.

(A) Thermal energy
(B) Solar energy
(C) Mechanical energy
(D) Chemical energy

54. The momentum of a particle is constant

(A) in the presence of external forces on a particle
(B) in the absence of external forces on a particle
(C) in the absence of internal forces on a particle
(D) in the presence of internal forces on a particle

55. When R is the position vector and P is the linear momentum of the particle at the given instant, the angular momentum of the particle (L) is defined as

(A) $L = R \times P$
(B) $L = R \cdot P$
(C) $L = R - P$
(D) $L = \frac{R}{P}$

56. The frames relative to which an unaccelerated body appears accelerated are called

(A) Inertial frames
(B) Non-inertial frames
(C) Unaccelerated frames
(D) Accelerated frames

57. If Lagrangian does not depend on time explicitly,
then the corresponding conserved quantity is

(A) Linear momentum
(B) Generalized momentum
(C) Angular momentum
(D) Mechanical energy

58. The force which is always directed towards a fixed center and magnitude of which is a function only of the distance from the fixed center, is known as

(A) Corioli's force
(B) Centripetal force
(C) Centrifugal force
(D) Central force

59. A rigid body moving freely in space has …….. degrees of freedom.

(A) 3
(B) 4
(C) 6
(D) 9

60. The law specifying the condition of transformation of heat into work is called the

(A) First law of thermodynamics
(B) Second law of thermodynamics
(C) Third law of thermodynamics
(D) Zeroth law of thermodynamics

61. In all reversible processes, entropy of a system remains

(A) Zero
(B) Low
(C) Constant
(D) High

62. Chemical potential is the rate of change of …….. per mole at constant volume and temperature.

(A) Electrical energy
(B) Molecular energy
(C) Free energy
(D) Thermal energy

63. The mean translational kinetic energy per molecule of an ideal gas is

(A) kT

(B) $\frac{1}{2}kT$

(C) $\frac{3}{2}kT$

(D) $\frac{2}{3}kT$

64. Photons obey …….. statistics.

(A) Maxwell Boltzmann
(B) Bose Einstein
(C) Fermi Dirac
(D) Depends on the system

65. Einstein's theory of specific heat

(A) Accepts different frequencies of molecular vibrations
(B) Accepts same frequency of all molecular vibrations
(C) Rejects molecular vibrations
(D) Rejects certain frequency range

66. The zeroth law of thermodynamics helps us to define the …….. of a system.

(A) Internal energy
(B) Temperature
(C) Pressure
(D) Entropy

67. The acceleration of electron in the first orbit of hydrogen atom is

(A) $\frac{4\pi^2 m}{h^3}$

(B) $\frac{h^2}{4\pi^2 mr}$

(C) $\frac{h^2}{4\pi^2 m^2 r^3}$

(D) $\frac{m^2 h^2}{4\pi^2 r^3}$

68. Which one of the following is positively charged?

(A) α-particles
(B) β-particles
(C) γ-rays
(D) X-rays

69. The fact that electric charges are integral multiples of the fundamental electronic charge was experimentally proved by

(A) Planck
(B) J.J. Thomson
(C) Einstein
(D) Millikan

70. Rutherford alpha particle scattering experiment results in the discovery of

(A) Electron
(B) Proton
(C) Nucleus of the atom
(D) Atomic mass

71. The fact that photons carry energy was established by

(A) Doppler's effect
(B) Compton' effect
(C) Bohr's theory
(D) Diffraction of light

72. In Bohr's model of hydrogen atom, which of the following pairs of quantities are quantized?

(A) Energy and linear momentum
(B) Linear momentum and angular momentum
(C) Energy and angular momentum
(D) Linear and spin

73. The number of atoms per unit cell of FCC crystal is

(A) 2
(B) 1
(C) 4
(D) 6

74. Crystal system having axial distance $a \neq b \neq c$ and axial angle $\alpha \neq \beta \neq \gamma \neq 90°$ is

(A) Tetragonal
(B) Triclinic
(C) Monoclinic
(D) Orthorhombic

75. For a superconductor, the critical magnetic field $\left(H_C\right)$ ……..
with decrease of temperature.

(A) increase
(B) decrease
(C) will not change
(D) vary negligibly

76. Torque plays the same role in …….. motion as force in …….. motion.

(A) vertical; horizontal
(B) twisting; bending
(C) rotator; translatory
(D) electronic; nuclear

77. The acceleration due to gravity at the pole is …….. that at the equator.

(A) equal to
(B) less than
(C) greater than
(D) two times

78. If a body is projected vertically upwards with a velocity 11.2 km/sec or more, the body

(A) will reach the earth's surface within a few minutes
(B) will have a projectile motion
(C) will return back immediately to the earth
(D) will not return to earth

79. The angular velocity of seconds hand of a watch will be

(A) $\frac{\pi}{60}$ rad/sec

(B) $\frac{\pi}{30}$ rad/sec

(C) 60π rad/sec

(D) 30π rad/sec

80. The differential equation $\frac{d^2y}{dt^2} + \omega^2 = 0,$ (where y and ω are displacement and angular velocity respectively) represents

(A) uniform linear motion
(B) simple harmonic motion
(C) Schrodinger's equation
(D) gravitational motion

81. A wheel completes 2000 rotations in covering a distance of 9.5 km.
The diameter of the wheel is

(A) 1.5 m
(B) 1.5 cm
(C) 7.5 cm
(D) 7.5 m

82. In a collision process, if the kinetic energy of the system is not conserved, then it is …….. collision.

(A) elastic
(B) inelastic
(C) direct
(D) indirect

83. A barometer kept in an elevator reads 76 cm when it is at rest. If the elevator goes up with increasing speed, the reading will be

(A) zero
(B) 76 cm
(C) < 76 cm
(D) > 76 cm

84. Bernoulli's theorem is based on the conservation of

(A) momentum
(B) energy
(C) mass
(D) angular momentum

85. There is a small hole near the bottom of an open tank filled with liquid. The speed of the liquid ejected will depend on

(A) height of the liquid from the hole
(B) area of the hole
(C) density of liquid
(D) All of the above

86. A cricket ball of mass 150 gm is moving with a velocity of 12 m/s and is hit by a bat so that the ball is turned back with a velocity of 20 m/s. The force of blow acts for 0.01 s on the ball. The average force exerted by the bat on the ball is

(A) 480 N
(B) 600 N
(C) 500 N
(D) 400 N

87. A pendulum suspended from the roof of a static train has a period T. If the train travels with a uniform acceleration 'a', the time period of the pendulum will

(A) increase
(B) decrease
(C) remain unaffected
(D) become infinite

88. A particle starts simple harmonic motion from the mean position. Its amplitude is A and time period is T. At the time when its speed is half of the maximum speed, its displacement y is

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

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

(C) $\frac{A}{\sqrt{2}}$

(D) $\frac{2A}{\sqrt{3}}$

89. Writing on a paper with a pen or pencil is an example for

(A) cohesive force
(B) adhesive force
(C) a good art
(D) pressure

90. Two capillary tubes of same material but of different radii are dipped in a same liquid. The rise of liquid in a first tube is 2.2 cm and that in the other is 6.6 cm. The ratio of their radius is

(A) 9 : 1
(B) 1 : 9
(C) 3 : 1
(D) 1 : 3

91. The matrix $\begin{pmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{pmatrix}$ is an example for …….. matrix.

(A) unitary
(B) orthogonal
(C) Hermitian
(D) skew-symmetric

92. A matrix A is called as idempotent matrix, if

(A) $A = A^T$
(B) $AA^T = 1$
(C) $A = A^{-1}$
(D) $A^2 = A$

93. $\nabla^2 \varphi = 0$, represents

(A) Laplace's equation
(B) Equation of continuity
(C) Wave equation
(D) Poission's equation

94. For a scalar function ϕ satisfying the Laplace equation, $\nabla\phi$ has

(A) zero curl and non-zero divergence
(B) non-zero curl and zero divergence
(C) curl and divergence, both zero
(D) curl and divergence both non-zero

95. For a gas at N T P, which of the following velocities will be maximum?

(A) Average
(B) R.M.S
(C) Most probable
(D) Maxwell's

96. A system of N non-interacting classical point particles is constrained to move on the two-dimensional surface of a sphere. The internal energy of the system is

(A) $\frac{3}{2}\ Nk_BT$
(B) $\frac{1}{2}\ Nk_BT$
(C) Nk_BT
(D) $\frac{5}{2}\ Nk_BT$

97. In an isothermal process on an ideal gas, the pressure increases by 0.5%. The volume decreases by

(A) 0.25%
(B) 0.5%
(C) 0.75%
(D) 1%

98. During an adiabatic process, if the pressure of a gas is proportional to the cube of its absolute temperature, then the value of $\frac{C_P}{C_V}$ for that gas is

(A) $\frac{3}{5}$

(B) $\frac{4}{3}$

(C) $\frac{5}{3}$

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

99. The water kept in a mud pot will cool due to the fact that

(A) cooling occurs due to evaporation
(B) cooling occurs due to conduction
(C) mud has the cooling nature
(D) mud absorbs the heat of water

100. The phenomenon which cannot be exhibited by the sound waves in air is

(A) interference
(B) diffraction
(C) polarization
(D) reflection

101. Standing waves are produced in 10 m long stretched string. If the string vibrates in 5 segments and wave velocity is 20 m/s, then its frequency in Hz is

(A) 5
(B) 4
(C) 2
(D) 10

102. An organ pipe open at both ends contains

(A) longitudinal stationary waves
(B) longitudinal travelling waves
(C) transverse stationary waves
(D) transverse railing waves

103. The focal length of a plano convex lens of curved surface with radius 40 cm and refractive index 1.5 is

(A) 60 cm
(B) 80 cm
(C) 100 cm
(D) 120 cm

104. Increase in refractive index with increase in wave length is known as

(A) dichroism
(B) deviation without dispersion
(C) normal dispersion
(D) anomalous dispersion

105. The rainbow will be visible only when the inclination of the Sun is

(A) equal to 52°
(B) > 52°
(C) < 42°
(D) > 42°

106. The height of a building can be determined using an optical instrument called

(A) binocular
(B) epidiascope
(C) telescope
(D) sextant

107. The experiment which proved that a light beam after reflection from an optically denser medium undergoes a phase change of π is

(A) Lloyd's single mirror
(B) Fresnel's mirrors
(C) Fresnel's biprism
(D) Billet's split lens

108. The number of distinct ways of placing four indistinguishable balls into five distinguishable boxes is

(A) 20
(B) 120
(C) 220
(D) 24

109. The energy of a particle in the n^{th} quantum state in a one dimensional closed box is proportional to

(A) n

(B) $\frac{1}{n}$

(C) n^2

(D) $\frac{1}{n^2}$

110. An X-ray has a wave length of 0.02 A.U. Its momentum is

(A) 2.126×10^{-23} kg m s^{-1}

(B) 3.313×10^{-22} kg m s^{-1}

(C) 3.45×10^{-25} kg m s^{-1}

(D) 6.626×10^{-22} kg m s^{-1}

111. Hall effect is exhibited by

(A) metals only
(B) semiconductors only
(C) both metals and semiconductors
(D) doped semiconductors only

112. A work function of a photoelectric material is 3.3 eV. The threshold frequency will be

(A) 8×10^{10} Hz

(B) 4×10^{14} Hz

(C) 8×10^{14} Hz

(D) 5×10^{20} Hz

113. The commutation relation between position and momentum operator is

(A) $[x, p_x] = i\hbar$

(B) $[x, p_x] = -i\hbar$

(C) $[x, p_x] = 0$

(D) $[x, p_x] = +1$

114. Which one of the following atoms cannot exhibit Bose-Einstein condensation, even in principle?

(A) $^{1}H_{1}$

(B) $^{4}H_{2}$

(C) $^{23}Na_{11}$

(D) $^{30}K_{19}$

115. If each fission of $_{92}U^{235}$ releases 200 MeV energy, then how many fissions must occur in one second to produce a power of 1 kW? (1 MeV = 1.6×10^{-13} Joule)

(A) 3.125×10^{13}

(B) 3.2×10^{14}

(C) 3.125×10^{15}

(D) 1.6×10^{16}

116. The packing fraction is zero for …….. by definition.

(A) $_{3}Li^{7}$

(B) $_{6}C^{12}$

(C) $_{50}Sn^{120}$

(D) $_{6}C^{13}$

117. Proton and neutron are …….., while
electron and positron are ……..

(A) baryons; leptons
(B) mesons; pions
(C) photons; gravitons
(D) bosons; mesons

118. The relation between Fermi energy and density of free electrons is

(A) $E_f \propto \rho^2$

(B) $E_f \propto \rho^{\frac{3}{2}}$

(C) $E_f \propto \rho^{\frac{2}{3}}$

(D) $E_f \propto \rho^{\frac{1}{2}}$

119. A magnetic dipole of moment m is placed in a non-uniform magnetic field B. If the position vector of the dipole is r, the torque acting on the dipole about the origin is

(A) $r \times (m \times B)$

(B) $r \times \nabla (m \cdot B)$

(C) $m \times B$

(D) $m \times B + r \times \nabla (m \cdot B)$

120. A plane electromagnetic wave travelling in free space is incident normally on a surface of refractive index 1.33. If there is no absorption by the surface, its reflectivity is

(A) 2%
(B) 20%
(C) 4%
(D) 40%

121. A proton and an α-particle enters in a uniform magnetic field with same velocity, then the ratio of the radii of path described by them is

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

122. A magnetic needle is kept in a non-uniform magnetic field. It experiences

(A) a force and a torque
(B) force but not torque
(C) torque but not a force
(D) neither torque nor force

123. If a force F is derivable from a potential function $V(r)$, where r is the distance from the origin of the coordinate system, it follows that

(A) $\nabla \times F = 0$

(B) $\nabla \cdot F = 0$

(C) $\nabla\, V(r) = 0$

(D) $\nabla^2 \mathrm{V} = 0$

124. The splitting of Sodium - D_2 line into six components in the presence of external magnetic field is due to

(A) normal longitudinal Zeeman effect
(B) normal transverse Zeeman effect
(C) anomalous Zeeman effect
(D) Stark effect

125. Among the molecules: H_2, NO, HCl, and N_2, Raman spectrum is observed for

(A) NO and HCl only

(B) H_2 and N_2 only

(C) All the four

(D) None of the above

126. According to Mosley's law, the frequency of a spectral line in the X-ray spectrum varies as

(A) atomic number of element
(B) square of the atomic number of element
(C) square root of the atomic number of element
(D) fourth power of atomic number of element

127. From the atomic state symbol $^3F_4$, we come to know the values of multiplicity, S, L, J as

(A) 1, 3, 3, 4

(B) $3, \frac{1}{2}, 3, 4$

(C) 3, 1, 3, 1

(D) 3, 1, 3, 4

128. The frequency of a simple harmonic oscillator is given by $\nu = \frac{1}{2\pi}\sqrt{\frac{k}{\mu}}$, where ν, k and μ represent

(A) wave number, constant and refractive index respectively
(B) frequency, Planck's constant and reduced mass respectively
(C) frequency, Boltzmann's constant and mass respectively
(D) frequency, force constant and reduced mass respectively

129. The number of normal modes of vibrations for a CO_2 molecule are

(A) 4
(B) 3
(C) 5
(D) 1

130. The speeds of Red light and Yellow light are exactly same

(A) in vacuum but not in air
(B) in vacuum as well as in air
(C) in air but not in vacuum
(D) neither in vacuum nor in air

131. Population inversion in He-Ne Laser is achieved by

(A) optical pumping
(B) chemical excitation
(C) chemical reaction
(D) inelastic atomic collision

132. Lande g-factor is a quantity

(A) with a dimension of velocity
(B) with a dimension of momentum
(C) with a dimension of angular momentum
(D) without any dimensions

133. A parallel plate capacitor is of 1 pF. If the distance between the plates is increased by a factor of two and the area is decreased by a factor of two, then its capacity will be

(A) 0.25 pF
(B) 0.5 pF
(C) 2 pF
(D) 4 pF

134. You are given three capacitors of 3 μF each. The capacitors may be connected in more than one way. The ratio of maximum capacitance to the minimum capacitance obtainable using them is

(A) 3 : 1
(B) 6 : 1
(C) 9 : 1
(D) 1.5 : 1

135. An AC current represented by 14.1 sin ($100\pi t$) is flowing through a resistance of 10 Ω. Then the heat produced is equal to

(A) 10 W
(B) 1000 W
(C) 2000 W
(D) 4000 W

136. A 12 V battery is connected to a 100 Ω resistance, the power developed across it and the current drawn from the battery is

(A) 0.144 W, 0.12 A
(B) 1.44 W, 1.2 A
(C) 0.144 W, 1.2 A
(D) 1.44 W, 0.12 A

137. Total number of crystallographic point groups is

(A) 14
(B) 28
(C) 32
(D) 40

138. If the inter planar spacing of (2 2 0) planes of a FCC structure is 1.7458 Å, then the lattice constant is

(A) 4.938 Å
(B) 2.458 Å
(C) zero
(D) 5.125 Å

139. The coordination number of body cantered cubic (BCC) structure is

(A) 4
(B) 12
(C) 2
(D) 8

140. While a collector to emitter voltage is constant in a transistor, the collector current changes by 8.2 mA, when the emitter current changes by 8.3 mA. The value of forward current ratio h_{fe} is

(A) 82
(B) 8.3
(C) 8.2
(D) 0.82

141. In a light emitting diode, the colour of emitted light depends on

(A) the current supplied to the diode
(B) the potential applied to the diode
(C) band gap of the material of the diode
(D) junction of the diode

142. Schottky diodes are made up of

(A) a metal and a p-type semiconductor
(B) a metal and an n-type semiconductor
(C) an insulator and a p-type semiconductor
(D) an insulator and an n-type semiconductor

143. For a three input AND gate, the number of possible input combinations are

(A) 4
(B) 8
(C) 9
(D) 16

144. The emitter of a transistor is heavily doped in general, because it

(A) has to dissipate maximum power
(B) has to supply the charge carriers
(C) is the first region of the transistor
(D) must possess low resistance

145. In a common emitter amplifier, the output resistance is 5000 Ω and the input resistance is 2000 Ω. If the peak value of the signal voltage is 10 mV and $\beta = 50$, then the peak value of the output voltage is

(A) 5×10^{-6} V
(B) 2.5×10^{-4} V
(C) 1.25 V
(D) 125 MV

146. A FET can be employed as

(A) an amplifier
(B) a switch
(C) a voltage variable resistor
(D) All the above

147. In an *RS* flip-flop, when the inputs are supplied with states $R = 0$ and $S = 1$, then the output Q will have the following action

(A) set
(B) reset
(C) no change
(D) forbidden

148. Qubits stand for

(A) Quadrupole binary transitions
(B) Quantum bits
(C) Quadrature binary digits
(D) Quarks in bits

149. The number of bits in a nibble is

(A) 16
(B) 8
(C) 4
(D) 0 or 1

150. A sphere, a cube and a thin circular plate made of the same material with the same mass are heated to the same temperature and allowed to cool, then the rate of cooling is

(A) maximum for the plate
(B) minimum for the cube
(C) maximum for the sphere
(D) same for all the three

FINAL ANSWER KEY

Subject Name: 613 PHYSICS

SI No.	Key	SI No.	Key	SI No.	Key	SI No.	Key	SI No.	Key
1	D	31	D	61	C	91	B	121	A
2	D	32	C	62	C	92	D	122	A
3	D	33	A	63	C	93	A	123	A
4	A	34	D	64	B	94	C	124	C
5	B	35	D	65	B	95	B	125	C
6	A	36	A	66	A	96	C	126	B
7	B	37	B	67	C	97	B	127	D
8	B	38	C	68	A	98	D	128	D
9	A	39	A	69	D	99	A	129	A
10	C	40	C	70	C	100	C	130	A
11	B	41	C	71	C	101	A	131	D
12	B	42	D	72	C	102	A	132	D
13	A	43	D	73	C	103	B	133	A
14	C	44	B	74	B	104	D	134	C
15	A	45	A	75	A	105	C	135	B
16	B	46	B	76	C	106	D	136	D
17	C	47	A	77	C	107	A	137	C
18	A	48	A	78	D	108	B	138	A
19	B	49	C	79	B	109	C	139	D
20	C	50	C	80	B	110	B	140	A
21	C	51	B	81	A	111	C	141	C
22	A	52	B	82	B	112	C	142	B
23	B	53	D	83	C	113	A	143	B
24	D	54	B	84	B	114	D	144	B
25	A	55	A	85	D	115	A	145	C
26	D	56	B	86	A	116	B	146	D
27	A	57	D	87	B	117	A	147	A
28	C	58	D	88	A	118	C	148	B
29	B	59	C	89	B	119	C	149	C
30	A	60	B	90	C	120	A	150	A