PHYSICS PG
(FINAL)

1. Find the combined focal length of a pair of thin converging lenses of powers 5 and 4 diopter respectively that are aligned co-axially at a distance of 10 cm

   (A) 14.29 cm
   (B) 28.58 cm
   (C) 12.43 cm
   (D) 8.76 cm

2. Young's double slit is applicable to find the

   (A) Spatial coherence of a laser beam
   (B) Temporal coherence of a laser beam
   (C) To analyse polarized light
   (D) To create polarized light

3. Select the medium that will yield the highly plane polarized and highly intense output for un-polarized red light impinging at Brewster's angle.

   (A) Highly flat flint glass plate (μ= 1.65)

   (B) Highly flat and polished Silicon (100) wafer (μ= 3.88)

   (C) Still water surface (μ= 1.33)

   (D) Surface of castor oil (μ= 1.47)

4. Select the appropriate polaroid spectacles for viewing a 3D movie

   (A)

   (B)

   (C)

(D)

5. In connection to the single slit diffraction phenomena, which one of the following is correct?

   (A) Single slit of width 0.1 mm diffracts X-rays
   (B) Single slit of width 0.1 mm does not diffract green laser beam
   (C) Single slit of width 0.1 mm diffracts beta-rays
   (D) Single slit of width 0.1 mm diffracts green laser beam

6. Which of the following phasor diagram represent the diffraction of 4th side maxima?

   (A)

   (B)

   (C)

   (D)
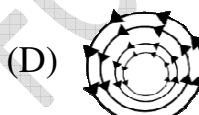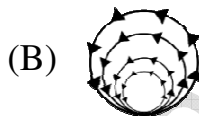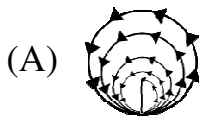
7. If the plane of vibration of the incident ray is 30 ° with the optic axis, the intensity ratio of the extraordinary and ordinary rays is,

   (A) 0.5
   (B) 6
   (C) 2

(D) 3

8. The wavenumber of the spectral line emitted by an excited hydrogen atom from $n_1 = 3$ to $n_2 = 5$ (Rydberg constant $R = 1.097 \times 10^7$/m) is,

(A) 7.8×10^5 /m
(B) 2.7×10^6 /m
(C) 1.3×10^4 /m
(D) 9.2×10^5 /m

9. The time lag for ejection of photoelectrons upon incident photons is,

(A) $> 10^{-5}$ s
(B) > 1 s
(C) $< 10^{-9}$ s
(D) Exactly 1 s

10. In the given nuclear reaction, the α decay takes place by,

$$Pu_{94}^{239} \xrightarrow{24,000 \text{ years}} U_{92}^{235} + He_2^4$$

(alpha particle)
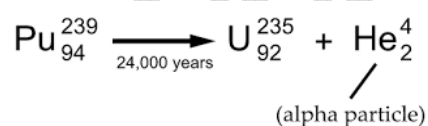
(A) Ionization
(B) β decay
(C) Annihilation
(D) Quantum tunnelling

11. Geiger-Muller counter calculates the $T_{1/2}$ of a radioactive species by measuring the

(A) Ionisation current
(B) Electronic current
(C) Thermal current
(D) Nuclear current

12. Select the correct logical operation indicated by the given equivalent circuit,
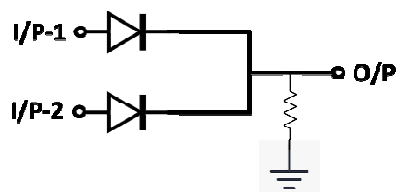
(A) OR logic
(B) NOR logic
(C) NAND logic
(D) AND logic

13. Select the condition that is true for a quartz crystal exhibiting double refraction.

(A) $\mu_o > \mu_e$ and $v_e < v_o$
(B) $\mu_o > \mu_e$ and $v_o < v_e$
(C) $\mu_e > \mu_o$ and $v_o < v_e$
(D) $\mu_e > \mu_o$ and $v_e < v_o$

14. In a Newton's rings setup, the diameter of the 10th ring shifts from 1.40 cm to 1.27 cm when a fluid is filled in-between the lens and the glass plate. Estimate the liquid's refractive index
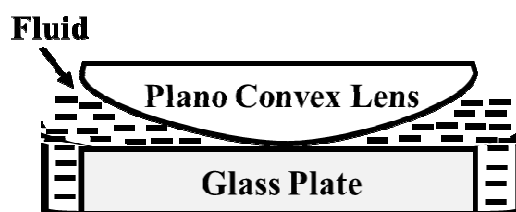
(A) $\mu = 1.525$
(B) $\mu = 1.352$
(C) $\mu = 1.215$
(D) $\mu = 1.425$

15. A dumb-bell made of glass of length 50 cm and $\mu=1.50$ has ends of 5 cm radius of curvature. Calculate the location of the image created by refraction at one of the ends, when a small object is located along the axis in air medium at a distance of 20 cm from the end of the dumb-bell.
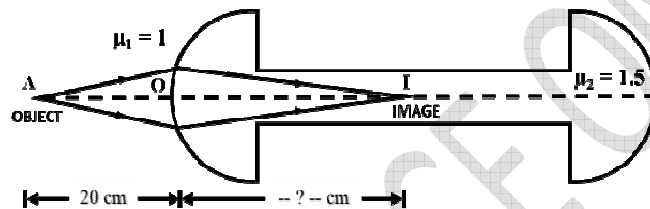
(A) Image is formed at 30 cm
(B) Image is formed symmetrically at 20 cm to right side
(C) Image is formed at 10 cm
(D) Image is formed at 15 cm

16. A forward biased p-n-p transistor, when utilized as an amplifier, a

(A) large number of electrons move to base from emitter
(B) large number of holes move to base from emitter
(C) large number of holes move to emitter from base
(D) large number of electrons move from base to emitter

17. The circuit containing two diodes each with a forward resistance of 50 ohm and with reverse resistance being infinite. If the source voltage is 6V, the current through the 120 ohm resistor is

D$_1$ 130 Ω

D$_2$ 100 Ω

120 Ω

6 V
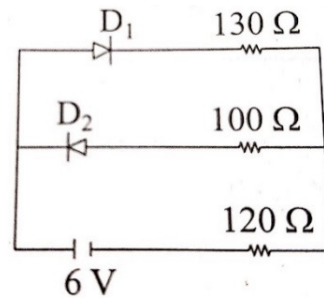
(A) 2 mA
(B) 12 mA
(C) 20 mA
(D) 84 mA

18. Which of the following arrangements will produce the most sustained interference pattern?

A   B   C   D

Extended Source
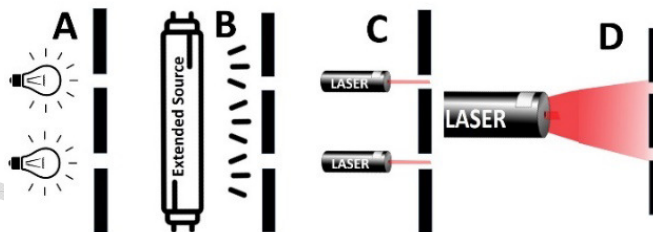
LASER

LASER

LASER

(A) Single extended light source (Figure B)
(B) Two lasers for independent slits (Figure C)
(C) Single laser covering both the slits (Figure D)
(D) Two independent light sources (Figure A)

19. X-rays with wavelength 1.54 Å are diffracted from (1 1 0) plane of a cubic crystal with unit cell 'a' = 6 Å. Inter-planar spacing and Bragg angle, θ, for 1st order reflection are,

(A) d = 1.24 Å and θ = 1.46°
(B) d = 2.24 Å and θ = 5.46°

(C)   d = 4.24 Å and θ = 10.46°

(D)   d = 3.24 Å and θ = 15.6°

20.   Which one is the Haidinger fringe among the figures given here?
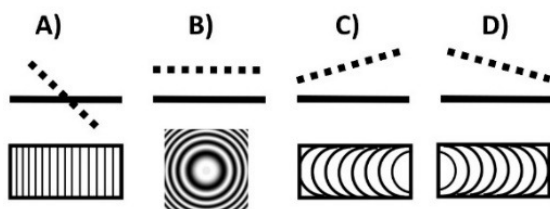
(A)   Image A

(B)   Image B

(C)   Images C and D

(D)   Images A and B

21.   The energy available in radio frequency radiation is capable of inducing which of the following transition?

(A)   Exciting atomic energy levels

(B)   Affect the nuclear spin of a nucleus of an atom

(C)   Vibrate a molecule

(D)   Vibrate an atom

22.   Positronium is a combination of,

(A)   Positron and Helium

(B)   Positron and α - particle

(C)   Photon and β - particle

(D)   Positron and β - particle

23. Select the correct truth table for the circuit shown below

	x	y	z
(A)	0	0	1
	0	1	1
	1	0	1
	1	1	0

	x	y	z
(B)	0	0	0
	0	1	0
	1	0	0
	1	1	1

	x	y	z
(C)	0	0	1
	0	1	1
	1	0	1
	1	1	1
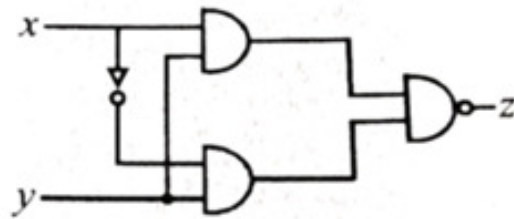
	x	y	z
(D)	0	0	0
	0	1	1
	1	0	1
	1	1	1

24. The electric field near a charged conducting sheet is proportional to

(A) Surface charge density, σ

(B) Permittivity of free space ε_0

(C) Reciprocal of σ

(D) $\varepsilon_0{}^2$

25. Differential form of Gauss's law is $\nabla.E =$

(A) $\rho\varepsilon_0$

(B) $\dfrac{\rho}{\varepsilon_0}$

(C) $\dfrac{\varepsilon_0}{\rho}$

(D) $\rho\varepsilon_0{}^2$

26. The potential at the center of a 1.0 m square having charges q, −2q, 3q, and 2q at its corners (q = 1×10^{-8} C, r 0.71m) is

(A) 50.7 V

(B) 5.07 V

(C) 507 V

(D) 5070 V

27. The Capacitance of the Parallel plate capacitor is proportional to

(A) The distance between the plates, d

(B) 1/d

(C) 1/A(area)

(D) d^2

28. The Capacitance of the Parallel plate capacitor is 400 pico Farad and its plates are separated by 2.0 mm of air. When the capacitor is charged to 1500 V, the energy of a capacitor is

(A) 45×10^{-4}J

(B) 45×10^4J

(C) 4.5×10^4J

(D) 4.5×10^{-4}J

29. Which of the following is a dielectric?

(A) Gold

(B) Silicon

(C) Mica

(D) Mercury

30. If the dielectric constant of a medium is 4 and electric field of the dielectricis

10^6 V/m then the electric displacement is

(A) $3.54 \times 10^{-6} Cm^{-2}$

(B) $35.4 \times 10^{-6} Cm^{-2}$

(C) $0.354 \times 10^{-6} Cm^{-2}$

(D) 4×10^6 v/m

31. The relation between D, E and P is

(A) $D = \varepsilon_0 E + P$

(B) $D = \varepsilon_0 P + E$

(C) $D = E + P$

(D) $D = \dfrac{E}{P}$

32. Sign of the carrier in an electrical conductor is known from

(A) Hall effect

(B) Doppler effect

(C) Seebeck effect

(D) Thomson effect

33. In a series resonance circuit $\omega L =$

(A) ωC

(B) $\omega^2 C$

(C) $\dfrac{1}{\omega C}$

(D) $\dfrac{1}{\omega^2 C}$

34. An emf of 10 volts is applied to a circuit having a resistance of 10 ohms and an inductance of 0.5 Henry. The time constant of the circuit (in seconds) is

(A) 20

(B) $\dfrac{1}{2}$

(C) 2

(D) $\dfrac{1}{20}$

35. In a step-up transformer, the relationship between number of turns in a secondary coil (N_s) and the number of turns in a primary coil (N_p) is

(A) $N_s = N_p$
(B) $N_s < N_p$
(C) $N_s > N_p$
(D) $N_s = N_p + 1$

36. Diodes which are operated in the breakdown region of their reverse characteristics are known as

(A) pn - junction diode
(B) PIN diode
(C) Zener diode
(D) Tunnel diode

37. Which of the following diode has negative resistance?

(A) Zener diode
(B) pn - junction diode
(C) PIN diode
(D) Tunnel diode

38. In RC low pass filter, the value of R is 5 kΩ and the cut-off frequency is 1 kHz then the value of C is

(A) 32 μF
(B) 0.32 μF
(C) 3.2 μF
(D) 0.032 μF

39. Number of bits in a byte are

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

(D) 1

40. The Decimal equivalent of a binary number 1111 is

(A) 15
(B) 8
(C) 4
(D) 16

41. The coefficient of Viscosity of a gas is

(A) independent of pressure
(B) dependent of pressure
(C) dependent of mass
(D) dependent of average molecular velocity

42. Mean free path λ of a gas molecule is

(A) inversely proportional to the square of the diameter
(B) inversely proportional to the pressure of the gas
(C) proportional to the absolute temperature
(D) All of the above

43. Relation between the efficiency 'η' of a Carnot's engine and the coefficient of performance 'K' of the Carnot's refrigerator is

(A) $\eta = 1/(K+1)$
(B) $\eta = (1/K)$
(C) $\eta = K+1$
(D) $\eta = 1- K$

44. The central core of the Sun is termed as

(A) Chromosphere
(B) Reversing layer
(C) Corona
(D) Photosphere

45. High temperatures are measured using a

   (A) Thermometer
   (B) Thermocouple
   (C) Pyrometer
   (D) Thermister

46. The value of the solar constant is

   (A) 1340 W/m^2
   (B) 134.0 W/m^2
   (C) 13.40 W/m^2
   (D) 1.340 W/m^2

47. The failure of the lens to form a point image of an axial point object is called

   (A) Astigmatism
   (B) Coma
   (C) Curvature
   (D) Spherical aberration

48. In the Newton's Rings experiment, the diameter of 10th dark ring is 0.433 cm and radius of the curvature of the lens is 70 cm. The wavelength of the incident light is

   (A) 6695 Å
   (B) 669.5 Å
   (C) 66.95 Å
   (D) None of the above

49. A telescope with larger diameter of objective has a

   (A) higher resolving power
   (B) lower resolving power
   (C) zero resolving power
   (D) infinite resolving power

50. A grating has 15 cm of the surface ruled with 6000 lines per cm. The resolving power of the grating in the first order is

   (A) 9000
   (B) 90000
   (C) 6000
   (D) 900

51. If the two lenses of 16 cm and 12 cm form a combination, which is corrected for spherical aberration, then the distance between the principal points of the combination is

   (A) 4 cm
   (B) 16 cm
   (C) 12 cm
   (D) 28 cm

52. The amount of rotation 'θ' produced by an optically active substance is proportional to its

   (A) thickness (l)
   (B) concentration of solution
   (C) inversely square of wavelength (λ)employed
   (D) All of the above

53. Light propagation in an optical fiber is based on

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

54. A rocket burns 0.02kg of fuel per second ejecting it as a gas with velocity of
   10,000 m/s. The force that the gas exert on the rocket is

   (A) 2N
   (B) 20N

(C) 200N

(D) 2000N

55. A couple 20Nm is applied to a flywheel of mass 10kg and radius of gyration 0.5m. The resultant angular acceleration is

(A) 8 rad/s^2

(B) 8 rad/s

(C) 80 rad/s^2

(D) 20 rad/s^2

56. If Young's modulus is 12.25×10^{10} Nm^{-2} and rigidity modulus is 4.55×10^{10} Nm^{-2} then the Poisson's ratio of silver is

(A) 1.34

(B) 2.34

(C) 0.34

(D) -2.34

57. The square of the period of revolution of the planet around the Sun is directly proportional to

(A) cube of semi-major axis

(B) square of semi-major axis

(C) cube of semi-minor axis

(D) semi-major axis

58. The height of the geostationary satellite orbit from the surface of Earth is (approximately)

(A) 36000 km

(B) 3600 km

(C) 360 km

(D) 600 km

59. Ultrasonic waves move

(A) as fast as sound waves

(B) at velocity of light waves

(C) faster than sound waves

(D) slower than sound waves

60. The Y-cut slabs produce

    (A) Longitudinal waves
    (B) Shear waves
    (C) Transverse waves
    (D) Torsional waves

61. If two tuning forks with frequencies 256 Hz and 251 Hz are sounded together, then the beats produced per second is

    (A) 256
    (B) 251
    (C) 5
    (D) 507

62. In case of Lissajous figure, the combination of two harmonic motions with same frequency but having a phase difference of $\pi/4$ is

    (A) straight line
    (B) hyperbola
    (C) figure of eight
    (D) ellipse

63. If a wire of mass 0.001kg and length 2.5 m is under tension of 1 N then the frequency of the wire is

    (A) 1000 Hz
    (B) 100 Hz
    (C) 1 Hz
    (D) 10 Hz

64. Raman spectra are used to determine

    (A) molecular structure
    (B) surface morphology
    (C) particle size
    (D) band gap of the material

65. The state of an electron in an atom is completely specified by
    ……………quantum numbers

    (A) Four
    (B) Three
    (C) Two
    (D) One

66. Which one of the following is NOT a magic number?

    (A) 2
    (B) 10
    (C) 20
    (D) 8

67. In the Bragg's equation for X-ray diffraction: $2d\sin\theta = n\lambda$, 'd' denotes

    (A) diameter
    (B) atomic number
    (C) inter planar spacing
    (D) density

68. Accelerated electrons incident on a Tungsten target will produce

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

69. The magnetic lines of force cannot penetrate the body of a
    superconductor. This effect is known as

    (A) Meissner effect
    (B) Isotopic effect
    (C) Miller effect
    (D) Compton effect

70. If $r = ix + jy + kz$ is a position vector, then $\nabla \cdot r$ and $\nabla \times r$ are respectively,

    (A) 0, 3

(B) 3, 0
(C) 0, 0
(D) 3, 3

71. A certain matrix is given below. If it has to be symmetric matrix, what are the values of x, y and z respectively?

$$\begin{vmatrix} 0 & 2 & 3 \\ x & 0 & 4 \\ y & z & 0 \end{vmatrix}$$

(A) 2, 3, 4
(B) 4, 3, 2
(C) 1, 2, 3
(D) 0, 1, 2

72. If $A = a_1 i + a_2 j + a_3 k$, where a_1, a_2 and a_3 are constants, $\nabla \cdot A$ is

(A) 1
(B) zero
(C) $a_1 + a_2 + a_3$
(D) $i + j + k$

73. Pick out the correct choice from the following

(A) Curl grad = 0
(B) Div grad = 0
(C) Curl Curl = 0
(D) Grad div = 0

74. The dimensions of the Planck's constant (h) in terms of Mass (M), length (L) and time (T) are

(A) $M L^2 T^{-1}$
(B) $M L^2 T^{-2}$
(C) $M L T^{-1}$
(D) $M L T^{-2}$

75. A 60 kg man pushes a 40 kg man with a force of 60 N. Then, the 40 kg man exerts a force of ……… on the other man?

 (A) 40 N
 (B) 60 N
 (C) 0 N
 (D) 20 N

76. The sum of all electromagnetic forces between different particles of a system of charged particles is zero

 (A) only if all the particles are positively charged
 (B) only if all the particles are negatively charged
 (C) only if half the particles are positively charged and half are negatively charged
 (D) irrespective of the polarity of the charges

77. The formulation of D'Alembert's principle is equivalent to

 (A) Newton's First law of motion
 (B) Newton's Second law of motion
 (C) First law of thermodynamics
 (D) Second law of thermodynamics

78. A person travelling on a straight line moves with a uniform velocity V_1 for a distance x and with a uniform velocity V_2 for the next equal distance. The average velocity V is then given by

 (A) $V = \dfrac{V_1 + V_2}{2}$

 (B) $V = \sqrt{V_1 V_2}$

(C) $\dfrac{2}{V} = \dfrac{1}{V_1} + \dfrac{1}{V_2}$

(D) $\dfrac{1}{V} = \dfrac{1}{V_1} + \dfrac{1}{V_2}$

79. $\dfrac{d^2\theta}{dt^2} + \dfrac{g}{l}\theta = 0$ represents the equation of motion of a

(A) Simple pendulum
(B) Compound pendulum
(C) Harmonic Oscillator
(D) Spring and mass system

80. A dimensionless quantity

(A) always possesses a unit
(B) never possesses a unit
(C) may or may not possess a unit
(D) does not exist at all

81. For a particle of mass 10 g, the position vector and velocity are given by $r = (10\hat{i} + 6\hat{j})$ cm and $V = 5\hat{i}$ cm/s. The angular momentum of the particle at the origin is then

(A) 50 g.cm^2/s
(B) 300 $\hat{k}$ g.cm^2/s
(C) 50 $\hat{k}$ g.cm^2/s
(D) 300 g.cm^2/s

82. The force between two charges q_1 and q_2 is 30 N when they are at a distance 'd' apart. To increase the force between them to 60 N, they must be kept at a distance of

(A) $\sqrt{2}d$

(B) $2d$

(C) $\dfrac{d}{2}$

(D) $\dfrac{d}{\sqrt{2}}$

83. Eddy currents developed on a conductor moving in a magnetic field will tend to

    (A) speed up the motion

    (B) tend to slow down the motion

    (C) tend to rotate the conductor

    (D) oscillate the conductor

84. 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) $\nabla \times \vec{E} = -\dfrac{\partial \vec{B}}{\partial t}$

85. The energy stored in a capacitor of 200 µF charged to 100 V is

    (A) 10 ergs

    (B) 1 J

    (C) 1 erg

    (D) 10 J

86. The force (F) experienced by a charge q situated in an electric field of strength (E) is given by

    (A) $F = qE$

    (B) $F = q^2E$

    (C) $F = \dfrac{E}{q}$

    (D) $F = \dfrac{kE^2}{8\pi}$

87. The potential of an electric dipole depend on the distance r from the dipole as

    (A) $\dfrac{1}{r}$

    (B) r^2

    (C) $\dfrac{1}{r^2}$

    (D) $\dfrac{1}{r^3}$

88. Magnetic flux density measures

    (A) the number of lines of force
    (B) the number of lines of force passing per unit time
    (C) the number of lines of force passing through unit area
    (D) number of lines of force per unit volume

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

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

90.   The equation of continuity in electromagnetic theory is a restatement of

(A)   law of conservation of energy
(B)   law of conservation of electric charges
(C)   law of conservation of momentum
(D)   law of conservation of mass

91.   Dispersion in a medium is said to be normal if the

(A)   refractive index remains constant with change in frequency
(B)   refractive index increases monotonically with frequency
(C)   refractive index decreases with increase in frequency
(D)   refractive index changes abruptly as frequency increases

92.   The rise of a liquid in a capillary tube does NOT depend on

(A)   the property of the liquid
(B)   the length of the capillary tube
(C)   inner radius of the capillary tube
(D)   outer radius of the capillary tube

93.   The critical velocity of a fluid at which the streamline motion ceases to occur does NOT depend on

(A)   Velocity of the fluid
(B)   Density of the fluid
(C)   Viscosity of the fluid
(D)   Diameter of the tube through which fluid flows

94.   According to Poiseuille's equation for flow of liquids through a capillary, the viscosity of the liquid is proportional to

(A)   Radius of the tube
(B)   Square of the radius of the tube
(C)   Fourth power of the radius of the tube
(D)   Inverse of the radius of the tube

95.   A simple pendulum has a hollow bob filled with a liquid. As the pendulum oscillates, the liquid leaks out of a hole in the bob. The period of oscillation of the pendulum will then

(A) decrease as a function of time
(B) increase as a function of time
(C) increase in the beginning and suddenly decreases at the end
(D) remains constant throughout

96. A certain source produces sound waves. If the intensity of the sound is increased by a factor 20, the sound level in decibels (dB) increased by

(A) 20 dB
(B) 10 dB
(C) 30 dB
(D) 13 dB

97. Two sound waves produced by the same source travel along different paths. If Δx is the path difference between them, then the phase difference (δ) between the two waves is

(A) $\delta = \dfrac{2\pi\Delta x}{\lambda}$

(B) $\delta = \Delta x\lambda$

(C) $\delta = \dfrac{\lambda\Delta x}{2\pi}$

(D) $\delta = 2\pi\lambda\Delta x$

98. The kinetic energy of the photoelectrons depend on the

(A) intensity of the radiation incident on the photoelectric material
(B) frequency of the incident radiation
(C) time for which the radiation is incident
(D) nature of the emitting surface

99. At relativistic speeds, with respect to a stationery observer

(A) Moving mass appears heavier, moving clock appears to run slower
(B) Moving mass appears lighter, moving clock appears to run slower
(C) Moving rod appears longer, moving clock appears to run slower
(D) Moving rod appears shorter, moving clock appears to run faster

100. If an experiment has N equally probable outcomes as events, the apriori probability of each event is

(A) N

(B) $\dfrac{1}{N}$

(C) 1

(D) $\dfrac{1}{N^2}$

101. Two photons approach each other with velocity '*c*'. Then their relative velocity will be

   (A) Zero
   (B) less than *c*
   (C) more than *c*
   (D) *c*

102. An electron is accelerated through a potential difference of 100 V. Then the de-Broglie wavelength associated with the electron wave is about

   (A) 1.23 Å
   (B) 100 Å
   (C) 1 A^a
   (D) 10 Å

103. The normalization condition for a wave function $\psi(x)$ is

   (A) $\displaystyle\int_{-\infty}^{\infty} \psi(x)\psi(x)dx = 1$

   (B) $\displaystyle\int_{-\infty}^{\infty} \psi(x)\psi^*(x)dx = 0$

   (C) $\displaystyle\int_{-\infty}^{\infty} \psi(x)\psi(x)dx = 0$

   (D) $\displaystyle\int_{0}^{\infty} \psi(x)\psi^*(x)dx = 0$

104. The expectation value of a position coordinate *x* of a particle is given by

(A) $\int_{-\infty}^{\infty} x |\psi|^2 \, dx$

(B) $\int_{-\infty}^{\infty} x^2 |\psi|^2 \, dx$

(C) $\int_{-\infty}^{\infty} x^2 |\psi| \, dx$

(D) $\int_{0}^{\infty} x |\psi|^2 \, dx$

105. For particle in a box of finite length, if E_o is the energy of the ground state, then the energies the first and second excited states E_1 and E_2 are respectively

(A) $4E_0$ and $8E_0$
(B) $4E_o$ and $9E_o$
(C) $2E_o$ and $8E_o$
(D) $2E_o$ and $3E_o$

106. For the simplest atom of the hydrogen element, the wave function of the atom

(A) depends only on principal quantum number n
(B) depends on both n and azimuthal quantum number l
(C) depends on n, l and magnetic quantum number m_l
(D) is independent of all these quantum numbers

107. The uncertainty relation cannot hold for the following pairs

(A) position and momentum
(B) energy and time
(C) linear momentum and angle
(D) angular momentum and angle

108. Dirac's relativistic theory predicts the existence of

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

109. The H-R diagram of stars directly compares the following properties of stars

    (A) size and density
    (B) temperature and luminosity
    (C) density and luminosity
    (D) distance and temperature

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

    (A) $M^{\frac{1}{2}}$
    (B) $M^{2.5}$
    (C) $M^{3.5}$
    (D) $M^{4.5}$

111. Due to Doppler effect, the shift in the wavelength observed is 0.1 Å for a star producing an emission line at 6000 Å. The velocity of the recession of the star is then

    (A) 5 km/s
    (B) 2.5 km/s
    (C) 10 km/s
    (D) 20 km/s

112. Which one of the following statements is NOT TRUE for the quantum linear harmonic oscillator?

    (A) The energy levels are equally spaced
    (B) The ground state energy is non zero
    (C) The potential energy curve is not a parabola

(D) Energy is quantized in steps of $h\nu$

113. The ratio of the atomic (electron) magnetic moment and the nuclear magnetic moment is about

(A) $\dfrac{1}{1000}$

(B) $\dfrac{1}{1836}$

(C) 1000

(D) 1836

114. Atoms with nuclear spin $I = \dfrac{1}{2}$ cannot exhibit

(A) Fine structure
(B) Magnetic interaction
(C) Quadruple interaction
(D) Hyperfine interaction

115. The wavelength difference between Sodium D_1 and D_2 lines is about

(A) 10 Å
(B) 6 Å
(C) 20 Å
(D) 2 Å

116. Optical spectrum primarily arises from the excitation of

(A) core electrons
(B) free electrons
(C) electrons from the ground state
(D) valence electrons

117. Pure rotational spectrum of a diatomic molecule occurs in the

(A) visible region
(B) microwave region
(C) ultraviolet region
(D) radio frequency region

118. The pure rotational energies of the states $E_{J=0}$, $E_{J=1}$ and $E_{J=2}$ are respectively (B is the rotational constant and J is the rotational quantum number)

(A) B, $2B$ and $3B$
(B) 0, $2B$ and $6B$
(C) 0, $2B$ and $4B$
(D) B, $4B$ and $8B$

119. The pure vibrational energies of the states $E_{V=0}$, $E_{V=1}$ and $E_{V=2}$ are respectively (V is the vibrational quantum number and v is the frequency)

(A) 0, $\dfrac{1}{2}hv$ and $\dfrac{3}{2}hv$

(B) hv, $\dfrac{1}{2}hv$ and $\dfrac{3}{2}hv$

(C) $\dfrac{1}{2}hv$, $\dfrac{3}{2}hv$ and $\dfrac{5}{2}hv$

(D) $\dfrac{3}{2}hv$, $\dfrac{5}{2}hv$ and $\dfrac{7}{2}hv$

120. The singlet state of a system corresponds to an effective electron spin S equal to

(A) 0

(B) $\dfrac{1}{2}$

(C) 1

(D) $\pm\dfrac{1}{2}$

121. In Zeeman effect, the splitting of the spectral lines of an atom is

(A) proportional to the strength of the magnetic field H
(B) proportional to H^2
(C) independent of the strength of the magnetic field H
(D) proportional to the $\sqrt{H}$

122. Which one of the following processes occurs without a change in internal energy?

(A) Isochoric process
(B) Isentropic process
(C) Steady-state process
(D) Isenthalpic process

123. 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)

124. At ordinary temperature, Hydrogen and Helium when passed through a porous plug, show heating effect because

(A) they are lighter gases
(B) their inversion temperature is below the room temperature
(C) their inversion temperature is above the room temperature
(D) their critical temperature is below the room temperature

125. Ascending air in the troposphere

(A) expands and heats up adiabatically
(B) expands and cools adiabatically
(C) contracts and heats up adiabatically
(D) contracts and cools adiabatically

126. Pirani gauge for the measurement of low pressure is based on the principle ofmeasurement of

(A) humidity of the medium
(B) electrical conductivity of the medium
(C) thermal conductivity of the medium

(D) dielectric property of the medium

127. Which one of the following is an inherent tendency of nature?

(A) To proceed from orderly state to disorder state
(B) To proceed from a state with less symmetry to more symmetric state
(C) To proceed from a state with more entropy to a state with less entropy
(D) To remain as it is in a given state

128. If the molar heat capacity of a gas at constant volume (C_v) is 5 cal/mol-K and the gas constant (R) is 2 cal/mol-K, then the ratio of the specific heats (γ) of the gas will be

(A) 1.4
(B) 0.72
(C) 2.5
(D) 3

129. If sun can be assumed to be a black body and the emission from it peaks at around 5000 Å , the effective temperature of the sun is

(A) 3000 K
(B) 6000 K
(C) 9000K
(D) 1000 K

130. Transition from excited nuclear energy states to ground state emits

(A) X-rays
(B) IR radiation
(C) UV radiation
(D) Gamma radiation

131. Which one of the following completely explains the characteristics of black body radiation?

(A) Wein's displacement law
(B) Rayleigh-Jeans law

(C) Planck's law

(D) Kirchoff's law

132. Which one of the following has zero packing fraction?

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

(B) $^{16}_{8}O$

(C) $^{14}_{7}N$

(D) $^{4}_{2}He$

133. Binding energy per nucleon of Helium nucleus is 7 MeV and that of Deuteron is 1 MeV. Then

(A) Helium nucleus is more stable

(B) Deuteron nucleus is more stable

(C) Both are equally stable

(D) Cannot say from binding energy values

134. If the nuclear radius of Al^{27} is 3.9 fm, then the approximate nuclear radius of Cu^{64} in Fermi is

(A) 5.2

(B) 3.9

(C) 2.4

(D) 1.2

135. During a nuclear fusion reaction,

(A) a heavy nucleus breaks into two fragments by itself

(B) a light nucleus bombarded by thermal radiation breaks up

(C) a heavy nucleus bombarded by thermal radiation breaks up

(D) two light nuclei combine to give a heavier nuclei and possible other products

136. The surface energy term in the semi-empirical mass formula is proportional to (A is the mass number)

(A) $A^{\frac{1}{3}}$

(B) $A^{\frac{2}{3}}$

(C) A

(D) A^2

137. The half -life period of Radium is 1600 years. Then the fraction of the sample of Radium that would remain after 6400 years is

(A) $\dfrac{1}{4}$

(B) $\dfrac{1}{2}$

(C) $\dfrac{1}{8}$

(D) $\dfrac{1}{16}$

138. Which one of the following nuclei has zero magnetic moment?

(A) C^{13}

(B) C^{12}

(C) N^{14}

(D) H^{1}

139. Scintillation counter works on the principle of

(A) Compton effect
(B) Photoelectric effect
(C) Kerr effect
(D) Fluorescent effect

140. Which one of the following statements is INCORRECT?

(A) Beta particles exist inside the nuclei
(B) Nuclear forces are charge independent

(C) When an electron meets a positron, they annihilate each other
(D) Neutrons produce more destructive effect on tissues than Gamma rays

141. Cadmium rods are used in nuclear reactors as

(A) moderators
(B) reflectors
(C) Absorbers
(D) catalyzers

142. There are three lumps of a given radioactive substance. Their activities are in the ratio 1 : 2 : 3. What will be the ratio of their activities at any future date?

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

143. A nucleus with an excess of neutrons may decay radioactively with an emission of

(A) a neutron
(B) a proton
(C) an electron
(D) a positron

144. The size of the atomic nucleus is of the order of

(A) 10^{-8} cm

(B) 10^{-13} cm

(C) 10^{-6} cm

(D) 10^{-15} cm

145. In any nuclear reaction, the reactants and the resultants must always be in conformity with the law of conservation of

(A) Energy only
(B) Charge number only
(C) Mass number only
(D) Charge number, mass number and energy

146. In β-decay, nuclei emit

   (A) electrons only
   (B) alpha particles
   (C) positrons only
   (D) electrons and neutrino

147. Which one of the following is a good nuclear fuel?

   (A) Uranium-236
   (B) Plutonium-239
   (C) Neptunium-239
   (D) Thorium-236

148. The angular velocity of a charged particle moving in a circular orbit under the influence of a magnetic field is given by (symbols have usual meaning)

   (A) $\omega = \dfrac{eH}{m}$

   (B) $\omega = \dfrac{m}{eH}$

   (C) $\omega = emH$
   (D) $\omega = mH$

149. Which one of the following statements about Cosmic rays is NOT true?

   (A) Cosmic rays are extremely penetrating radiation
   (B) Cosmic rays have extra terrestrial origin
   (C) Cosmic radiation is not homogeneous in nature
   (D) Majority of the cosmic ray particles are negatively charged

150. The law that relates the half life and range of α-particles for a large number of α-emitters is the

(A) Mosley's law
(B) Fermi Golden rule
(C) Curie Weiss law
(D) Geiger Nuttal law

ANSWER KEY

Subject Name: PHYSICS PG LEVEL

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