PHYSICS

1. Which one of the following is a set of dimensionless physical quantities?
   a. Strain, specific gravity, angle
   b. Strain, work, couple
   c. Work, angle, specific gravity
   d. Work, energy, frequency

2. If c is the velocity of electromagnetic radiation, e is the charge of an electron, m is the mass of an electron and h is the Plank's constant, then the combination of these universal constants that is dimensionless is,
   a. me^2/hc
   b. ch/me
   c. mc^2/h
   d. e^2/hc

3. The coordinates of a moving particle at time t are given by $x = at^2$ and $y = bt^2$. The equation for the path of the particle is
   a. $y = \frac{b}{a}x$
   b. $y^2 = 4abx$
   c. $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$
   d. $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$

4. A rocket of total initial mass m_0 is expelling exhaust gas at steady speed v_e with respect to itself. When its mass is reduced to $\frac{1}{e}m_0$, the velocity attained by the rocket will be
   a. $2v_e$
   b. $0.59\,v_e$
   c. [illegible]

5. A circular disc of mass 200 g and radium 1 cm is rotation about an axis passing through its centre and perpendicular to its plane. Its moment of inertia in ($kg.m^2$), is
   a. 1×10^{-3}
   b. 5×10^{-4}
   c. 1×10^{-2}
   d. 2

6. The centre of gravity of massive hill coincides with its centre of mass, only if
   a. The acceleration due to gravity has the same value over the entire mass distribution
   b. Its mass is distributed symmetrically about the centre of mass
   c. Its moment of inertia has a minimum value about an axis through the centre of gravity
   d. Its gravitational mass equals its initial mass

7. If the angular displacement of a body rotating with a constant angular acceleration is given by $\theta = 14t + 4t^2$, where θ is in radian and t in seconds, then its angular acceleration will be
   a. [illegible] rad/s
   b. 4 rad/s
   c. 2 rad/s
   d. 8 rad/s

8. Consider the following statements
   Assertion (A): The moment of inertia of a rigid body reduces to its minimum value, when the axis of rotation pass through its centre of gravity.
   Reason (R): The weight of a rigid body always acts through its centre gravity
   Of these statements
   a. Both A and R are true and R is the correct explanation of A
   b. Both A and R are true but R is not a correct explanation of A
   c. A is true but R is false
   d. A is false but R is true

9. Match List I with List II and select the correct answer using the codes given below the lines

   List I
   (Mathematical operation)
   A. Product of force and velocity
   B. Product of force and position vector
   C. Product of force and displacement
   D. Product of momentum and position vector

   List II
   (Resulting Physical Quantity)
   1. Power
   2. Angular momentum
   3. Work

4. Torque

Codes:

	A	B	C	D
a.	1	2	3	4
b.	2	1	4	3
c.	1	4	3	2
d.	3	2	1	4

10. If a lighter body (mass M_1 and velocity V_1) and a heavier body (mass M_2 and velocity V_2) have the same kinetic energy, then
    a. $M_2V_2 < M_1V_1$
    b. $M_2V_2 = M_1V_1$
    c. $M_2V_1 = M_1V_2$
    d. $M_2V_2 > M_1V_1$
11. A 10 kg body has a kinetic energy of 500 joules. Its momentum will be
    a. 25 kg-m/s
    b. 50 kg-m/s
    c. 100 kg-m/s
    d. 250 kg-m/s
12. A ball whose momentum is $\vec{p}$ trikes a wall at right angle and bounces off. The change in the momentum of the ball will be
    a. 0
    b. p/2
    c. p
    d. 2p
13. At the turning point of an oscillator, its potential energy is equal to
    a. zero
    b. its total energy
    c. its kinetic energy
    d. twice its kinetic energy
14. In case of frication between two bodies
    a. rolling friction > static friction > kinetic friction
    b. static friction < kinetic friction < rolling friction
    c. static friction > rolling friction > static friction
    d. static friction > kinetic friction > rolling friction
15. The escape velocity on the surface of the earth is v_0. If M and R are the mass and radius of the earth respectively, then the escape velocity on another planet of mass 2M and radius R/2 will be
    a. $4V_0$
    b. $2V_0$
    c. V_0
    d. $V_0/2$
16. Consider the following statements

A particle executing uniform circular motion has
1. tangential velocity
2. radial acceleration
3. tangential acceleration
4. radial velocity

Of these statements
a. 1 and 2 are correct
b. 1 and 3 are correct
c. 2 and 4 are correct
d. 3 and 4 are correct

17. A sphere of radius r_1 impinges on another sphere of radius r_2. The cross-section for collision is
    a. $\pi\left(r_1^2 + r_2^2\right)$
    b. $\pi\left(r_1 + r_2\right)^2$
    c. $\pi\left(r_1 - r_2\right)^2$
    d. $\left(r_1 - r_2\right)^4$
18. A particle moving with velocity 'V' collides with another particle of the same mass which is at rest. The velocity of centre of mass after the collision, is
    a. 2V
    b. $V\sqrt{2}$
    c. V
    d. V/2
19. An electron is moving in the positive X' direction in S' frame. The relative velocity between the S and S' frames is 0.8 c and the velocity of the electron is also 0.8 c with respect to an observer in S' frame. The velocity of the electron for an observer in the S frame is
    a. 1.6 c
    b. 1.0 c
    c. 0.975 c
    d. 0.875 c
20. Water flows through a horizontal pipeline of varying cross-section at the rate of 0.3 m^3/s. The velocity of water (in m/s) at a point of areas of cross-section 0.03 m^2 will be
    a. 0.09
    b. 3.00
    c. 9.00
    d. 10.00
21. Bernoulli's principle which is applicable to a fluid in motion, corresponds to the principle of conservation of
    a. linear momentum
    b. energy

c. mass
d. angular momentum

22. A capillary tube of length less than the "capillary height" for a given liquid in dipped in that liquid. Then the liquid will
a. overflow
b. rise to the top and bulge out
c. rise to the top and the curvature of the meniscus will decrease
d. not rise to the top

23. Consider the following statements
Assertion (A): A large soap bubble expands while a small bubble shrinks when they are connected to each other by a capillary tube.
Reason (R): The excess pressure (due to surface tension) inside a spherical bubble increases, as its volume decreases.
Of these statements
a. Both A and R are true and R is the correct explanation of A
b. Both A and R are true but R is not a correct explanation of A
c. A is true but R is false
A is false but R is true

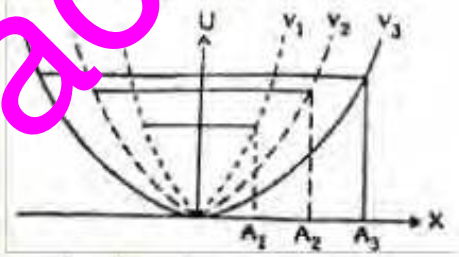
24. The terminal velocity of a spherical ball of radius 2r falling under gravity in a viscous fluid is V. The terminal velocity of another spherical ball of the same material but of radius r will be
a. V/8
b. V/4
c. V/2
d. $V/\sqrt{2}$

25. Air has dynamic viscosity 1.2×10^{-5} kg/ms. The highest velocity that a rain drop of diameter 0.3 mm can achieve is approximately
a. 2.2 m/s
b. 3.8 m/s
c. [illegible] m/s
d. 5 m/s

26. Consider the following statements:
Assertion (A): For underwater communication, sound waves with low frequency are better than those with high frequency.
Reason (R): Whenever the sound pressure amplitude exceeds that atmospheric and hydrostatic pressure (acting on water), it sets up eddy and turbulent motions in water.
Of these statements
a. Both A and R are true and R is the correct explanation of A
b. Both A and R are true but R is not a correct explanation of A
c. A is true but R is false
A is false but R is true

27. The superposition of two waves of the same frequency traveling in the same medium but in opposite directions gives rise to
a. resonance
b. beats
c. standing waves
d. harmonies

28. The potential energy, 'U' of three simple harmonic oscillators varies with displacement, 'X' as shown in the figure. These oscillators have the same mass but different amplitudes A_1, A_2 and A_3. Their characteristic frequencies ν_1, ν_2 and ν_3 are related to each other as



a. $\frac{\nu_1}{A_1} = \frac{\nu_2}{A_2} = \frac{\nu_3}{A_3}$
b. $\nu_1 A_1 = \nu_2 A_2 = \nu_3 A_3$
c. $\nu_1 > \nu_2 > \nu_3$
d. $\nu_1 < \nu_2 < \nu_3$

29. Two tuning forks, A and B, give 4 beats per second when sounded together. The frequency of A is 320 Hz. When some wax is added to B and sounded with fork A, 4 beats/sec are heard again. The frequency of B (in Hz), is
a. 312
b. 316
c. 324
d. 328

30. A car is moving towards a fixed wall and sends a signal having a frequency of 1000 Hz which is reflected back by a fixed wall and received by a detector in the same car. If the speed of the car is 0.2 V, V being the velocity of sound in air then the frequency (in Hz) as measured by the detector will be
a. 833
b. 1200
c. 1222

d. 1500

31. A lightly damped oscillator with a characteristic frequency "ω" is set in motion by harmonic driving force of frequency "ω'". When ω' ≈ ω, the response of the oscillator is controlled by
a. damping coefficient
b. inertia of the mass
c. oscillator frequency
d. spring constant

32. A stretched wire of length one meter is in resonance with a tuning fork. if the tension is doubted, then the length of the wire, (in m), at which resonance will take place, is
a. 0.70
b. 1.00
c. 1.41
d. 2.83

33. A vertical tube of length 1 m and diameter 4 cm is initially filled with water. A tuning fork of frequency 700 Hz is made to sound continuously over the top of the tube white the water is allowed to flow out gradually from the bottom. The highest harmonic that can be excited by this tuning fork is
a. ninth
b. seventh
c. fifth
d. third

34. One end of a string is connected to an electrically maintained vibrating bar while the other end is made to pass over a friction less pulley. The free end is then loaded so that the string is under tension T_1. The string vibrates in x_1 segments as the bar vibrates in transverse mode. If the tension is changed to T_2 the string vibrates in x_2 segments. Then
a. $x_1\sqrt{T_1} = x_2\sqrt{T_2}$
b. $\sqrt{T_1} = x_1\sqrt{T_2}$
c. $T_1\sqrt{x_2} = T_2\sqrt{x_1}$
d. $T_1\sqrt{x_1} = T_2\sqrt{x_2}$

35. Consider the following statements
Ultrasonic waves can be produced by a
1. magnetron oscillator
2. magnetostriction oscillator
3. klystron oscillator
4. piezoelectric oscillator
Of these statements
a. 1 and 4 are correct
b. 2 and 3 are correct
c. 1 and 3 are correct
d. 2 and 4 are correct

36. A system of two thin lenses of focal lengths $+f_1$ and $+f_2$ are separated by a distance, d. A paraxial ray enters the system from the left of lens 1 and leaves to the right of lens 2. The system matrix in this case will be
a. $\begin{bmatrix} 1 & 0 \\ 1/f_2 & 1 \end{bmatrix}\begin{bmatrix} 1 & -d \\ 0 & 1 \end{bmatrix}\begin{bmatrix} 1 & 0 \\ -1/f_1 & 1 \end{bmatrix}$
b. $\begin{bmatrix} 1 & 0 \\ -1/f_1 & 1 \end{bmatrix}\begin{bmatrix} 1 & -d \\ 0 & 1 \end{bmatrix}\begin{bmatrix} 1 & 0 \\ \cdots & \cdots \end{bmatrix}$
c. $\begin{bmatrix} 1 & 0 \\ -1/f_2 & 1 \end{bmatrix}\begin{bmatrix} 1 & d \\ 0 & 1 \end{bmatrix}\begin{bmatrix} 1 & 0 \\ -1/f_1 & 1 \end{bmatrix}$
d. $\begin{bmatrix} 1 & 0 \\ 1/f_2 & 1 \end{bmatrix}\begin{bmatrix} 1 & d \\ 0 & 1 \end{bmatrix}\begin{bmatrix} \cdots & 0 \\ -1/f_1 & 1 \end{bmatrix}$

37. For image magnifications, one needs atlea
a. two convex lenses
b. one concave and one convex lens
c. one Concave, lens
d. one convex lens

38. A small object lies on the axis of a cylindrically symmetric optical system. The image will suffer from
a. spherical aberration, coma and astigmatism
b. spherical aberration and coma
c. spherical aberration and astigmatism
d. spherical aberration

39. Two thin lenses have a combined power of +10 dioptres. When separated by 20 cm. their equivalent power is +6.25 dioptre. Their individual powers, in dioptres, are
a. 3.5 and 6.5
b. 5.0 and 5.0
c. 7.5 and 2.5
d. 9.0 and 1.0

40. Consider the following statements
A compound microscope is better than single-lens micro-scope because
1. it can produce larger magnification
2. it has better resolution
3. it produces images free of all defects
Of these statements
a. 1, 2 and 3 are correct
b. 1 and 2 are correct
c. 2 and 3 are correct
d. 1 and 3 are correct

41. When a light wave gets refracted into a denser medium, the speed of propagation
a. increases but the wavelength decreases

b. decreases but the wavelength increases
c. as well as the wavelength increase
d. as well as the wavelength decrease

42. A double slit is illuminated by two wavelengths 450 nm and 600 nm. What is the lowest order at which the maxima of one wavelength coincides with the minima of the ether wavelength?
a. 1
b. 2
c. 3
d. 4

43. In Young's experiment, the phase difference between two waves of a point where destructive interference takes places is
a. 0
b. $\pi/4$
c. $\pi/2$
d. π

44. The minimum number of lines in a grating which will just resolve the spectral lines of wavelength 5880 A^0 and 5886 A in the second order is
a. 491
b. 981
c. 2940
d. 2943

45. In the far-field diffraction pattern of a single slit under polychromatic illumination, the first minimum with the wavelength λ_1 is found to be coincident with the third minimum at λ_2. Then the relationship between these two wavelengths is
a. $3\lambda_1 = 0.3\lambda_2$
b. $3\lambda_1 = \lambda_2$
c. $\lambda_1 = 3\lambda_2$
d. $0.3\lambda_1 = 3\lambda_2$

46. The diameter of the eighth zone in a zone plate is 3 mm. Its principal focal length for light of wavelength 5000 A^0 is
a. 0.85 m
b. 1.25 m
c. 2.25 m
d. 3.00 m

47. A uni-axial birefringent crystal is cut to form a parallel plate with its optic axis parallel to the front face. For such a retarder plate of refractive indices n_0 and n_e, with thickness d, the expression for the relative phase difference, $\Delta\phi$ for the wavelength λ is given by
a. $\frac{|n_0 - n_e|d}{\lambda}$
b. $\frac{|n_0 - n_e|\lambda}{d}$
c. $\frac{2\pi|n_0 - n_e|\lambda}{d}$
d. $\frac{2\pi|n_0 - n_e|d}{\lambda}$

48. Two polarising sheets P_1 and P_2 are placed such that the angle between polarising directions of P_1 and P_2 is θ. If I_1 is the intensity of light as it emerges out of P_1, then the transmitted intensity through P_2 will be
a. 0
b. $I_1\cos^2\theta$
c. $I_1\cos\theta$
d. $I_1\sin^2\theta$

49. Sodium light is used to study the circular fringes of a Michelson's interferometer. The distances of separation of the two mirrors for two consecutive positions of east contra were equal to d_1 and d_2. If λ_1 and λ_2 are the wavelengths of the two lines of sodium light, then their difference (λ_1-λ_2) is equal is
a. $\frac{\lambda_1\lambda_2}{2(d_2 - d_1)}$
b. $\frac{\lambda_1\lambda_2}{2(d_2 + d_1)}$
c. $\frac{3\lambda_1\lambda_2}{2(d_2 - d_1)}$
d. $\frac{\lambda_1\lambda_2}{(d_2 + d_1)}$

50. La Rayleigh scattering of light with frequency v, the co-efficient of scattering is proportional to
a. v
b. v^2
c. v^3
d. v^4

51. Consider the following statements
In Raman scattering of light by gases
1. Stokes lines appear on the higher wavelength side of the exciting line
2. Anti-Stokes lines appear on the lower wavelength side of the exciting line
3. Anti-Stokes lines are of much higher intensity than the corresponding Stokes lines

Of the above statements

a. 1, 2 and 3 are correct
b. 1 and 2 are correct
c. 2 and 3 are correct
d. 1 and 3 are correct

52. A laser beam of pulse power 10^{12} Watt as focussed on an object of area 10^{-4} cm^2. The energy flux in Watt/cm^2, at the point of focus is
a. 10^{20}
b. 10^{16}
c. 10^{8}
d. 10^{4}

53. The population inversion in Helium-Neon laser is produced by
a. photon excitation
b. electron excitation
c. inelastic atomic collisions
d. chemical reaction

54. Consider the following statements:
Assertion (A): CO_2 lasers are much more efficient than other lasers.
Reason (R): The vibrational-rotational levels of the lowest electric state are involved in the CO_2 laser transitions.
Of these statements
a. Both A and R are true and R is the correct explanation of A
b. Both A and R are true but R is not the correct explanation of A
c. A is true but R is false
d. A is false but R is true

55. When the temperature of a gas is increased at constant pressure, the potential energy of the molecules
a. increases but their kinetic energy decreases
b. decreases but their kinetic energy increases
c. as well as their kinetic energy decrease
d. as well as their kinetic energy increase

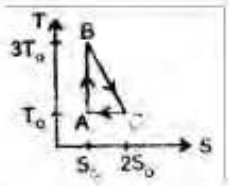
56. The temperatures measured using a constant volume (Vo) hydrogen thermometer, coincide with those measured using a constant pressure (Po) hydrogen thermometer, only when
a. both Vo and Po are small
b. Vo is small and Po is large
c. Vo is large and Po is small
d. both Vo and Po are large

57. The theoretical values of the molar specific heats of solids, deduced on the basis of the law of equipartition of energy are always smaller than their experimental values. This discrepancy is attributed to the
a. exclusion of the electronic contributions to specific heats
b. errors in the measurements of specific heats
c. approximations in the calculations of specific heats
d. non-zero values of the thermal expansion coefficients

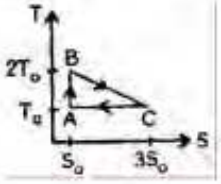
58. Three identical metal rods A, B and C are placed end to end and a temperature difference is maintained between the free ends of A and C. If the thermal conductivity of B (K_B) is twice that of C (K_C) and half that of A (K_A), then the effective thermal conductivity of the system will be
a. $K_A/7$
b. $6K_B/7$
c. $K_B/3$
d. $7K_B$

59. Oxygen gas with an initial volume of 8 m^3 is allowed to expand from 4 atomospheres to 1 atmosphere. Once the equilibrium temperature is reached, the gas is compressed to its original volume. If the final entropy were higher than its initial entropy, then the gas had undergone
a. adiabatic expansion and isothermal compression
b. isothermal expansion and adiabatic compression
c. free expansion and isothermal compression
d. adiabatic expansion and isobaric compression

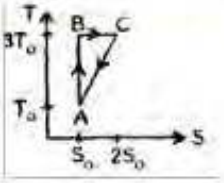
60. Which one of the following reversible cycles represented by right angled triangles in a T-S diagram, is the least efficient?
a.



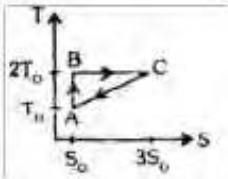
b.



c.



d.



61. The pressure on a block of silver is increased quasistatically and isothermally from 1 to 2000 atmospheres. The amount of heat liberated during this process is
a. exactly equal to the work done
b. more than the change in the internal energy
c. less than the change in the internal energy
d. less than the work done

62. The temperature of a gas is held constant while its volume is decreased. The pressure exerted by the gas on the walls of the container increases because its molecules
a. strike the walls with higher velocities
b. strike the walls with larger force
c. strike the walls more frequently
d. are in contact with the wall for a shorter time

63. The mean square displacement of a particle under going Brownian motion at a temperature T is proportional to
a. 1/T
b. $1/\sqrt{T}$
c. $\sqrt{T}$
d. T

64. Colloidal particles of mass M are suspended in a gas at 300 K and 1 atmosphere. The most probable energy of these particles is equal to the kinetic energy of a gas molecule moving with the most probable velocity, V_p, at the temperature
a. 450 K
b. 380 K
c. 300 K
d. 150 K

65. A non-conducting partition divides a container into two equal compartments. One is filled with helium gas at 400 K and the other is filled with carbon monoxide gas at 240 K. The number of molecules in each gas is the same. If the partition is removed to allow the gases to mix, then the final equilibrium temperature will be
a. 300 K
b. 320 K
c. 340 K
d. 352 K

66. The viscosity of a gas arises from the transport of momentum from 'high velocity' region to 'low velocity' region. The mean square velocity of those molecules which carry momentum across a hypothetical layer of the gas is given by
a. kT/m
b. 2 kT/m
c. 2.5 kT/m
d. 4 kT/m

67. A gas at pressure P, volume V and temperature T has a mean free path of λ. If this gas is isothermally compressed to a volume V/2, then the mean free path will be
a. 2λ
b. λ
c. $\lambda/\sqrt{2}$
d. λ/2

68. Carbon dioxide gas at an initial pressure of 50 atm and a temperature of 300 K undergoes an adiabatic, free expansion in which the final volume is 20 times that of the original volume. The change in the temperature of the gas is equal to
a. 33°C
b. 3.3°C
c. 0°C
d. -33°C

69. The Joule-Thomson expansion produces cooling
a. at all initial temperatures and pressures
b. above certain initial temperature
c. above certain initial pressure
d. below certain initial temperature

70. If the volume black body radiation increased is increased quasistitically and adiabatically by a factor of 8, then the wavelength of the highest intensity λ_m, will shift to
a. $1/2\ \lambda_m$
b. $2\ \lambda_m$
c. $2\sqrt{2}\ \lambda_m$
d. $8\lambda_m$

71. According to Planck's law of black body radiation, a hotter body radiates

a. most of the energy in the longer wavelength region
b. most of the energy in the shorter wavelength region
c. equal amount of energy in all regions of wavelengths
d. energy in bands separated by gaps

72. Consider the following statements:
Assertion (A): The root mean square velocity of molecules of a gas having Maxwellian distribution of velocities, is higher than their most probable velocity, at any temperature
Reason (R): A very small number of molecules of a gas which possess very large velocities increase the root mean square velocity, without affecting the most probable velocity
Of these statements
a. Both A and R are true and R is the correct explanation of A
b. Both A and R are true but R is not a correct explanation of A
c. A is true but R is false
d. A is false but R is true

73. A horizontal overhead power line carries a current of 100 A directed from West to East. The magnetic field due to the current 2m below the line is
a. 1.00×10^{-5} T towards South
b. 1.00×10^{-5} T towards North
c. 3.14×10^{-5} T towards South
d. 3.14×10^{-5} T towards North

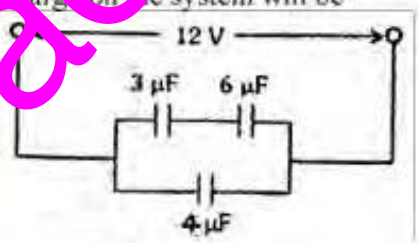
74. Consider the following statements:
Ferromagnetism arises due to
1. orbital angular momentum of the electrons
2. spin angular momentum of the electrons
3. spin angular momentum of the nucleus
Of the above statements
a. 1 and 2 are correct
b. 2 and 3 are correct
c. 1 alone is correct
d. 2 alone is correct

75. A paramagnetic material is introduced into a current carrying toroid. The magnetization of this material does not alter the
a. magnetic field strength, H anywhere inside the toroid
b. self inductance, L of the toroid
c. reluctance, R of the magnetic circuit in the toroid
d. energy stored in the toroid

76. On a conductor of non-uniform curvature, the charge
a. has the greatest concentration on the parts of greatest curvature
b. has the greatest concentration on the parts of least curvature
c. is distributed uniformly on the whole surface
d. is distributed uniformly over its volume

77. At a point on the axis of an electric dipole
a. the electric field is zero
b. the electric potential is zero
c. neither the electric field nor the electric potential is zero
d. the electric field is directed perpendicular to the axis

78. Three capacitors are connected as shown in the figure. If a potential difference of 12 V is applied to the terminals, then the total charge on the system will be



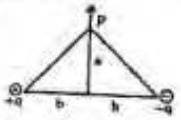
a. 24 μC
b. 48 μC
c. 72 μC
d. 108 μC

79. The application of 'Gauss' theorem gives rise to an easy evaluation of electric field in the case of
a. a charged body of any geometrical configuration
b. charged bodies of regular geometrical configuration
c. revolving charged bodies
d. charges forming dipoles

80. A total capacitance of 4 μF can be obtained by combining four capacitors of 3 μF each, if
a. all the capacitors are in parallel
b. all the capacitors are in series
c. three capacitors are in series and one capacitor is in parallel to that of the combination
d. one capacitor is in series with the combination of three capacitors in parallel

81. Kirchhoff's first law for electric circuits is based on the law of conservation of
a. charge
b. energy
c. momentum
d. mass as well as energy

82. If charges +q and —q are placed at the two corners shown of a triangle as shown in Fig., then the potential at the third corner will be



a. $\frac{1}{4\pi\varepsilon_0}\frac{2q}{\sqrt{a^2+b^2}}$
b. Zero
c. $\frac{1}{4\pi\varepsilon_0}\frac{q}{\sqrt{a^2+b^2}}$
d. $\frac{1}{4\pi\varepsilon_0}\frac{(-q)}{\sqrt{a^2+b^2}}$

83. Which one of the following can produce the maximum induced emf?
a. 50 A, DC
b. 50 A, 50 Hz AC
c. 50 A, 500 Hz AC
d. 100 A, DC

84. A circular coil A of 50 turns of fine wire, 4 cm^2 in cross sectional area is placed coaxially at the centre of a circular coil B of 10 cm radius and 100 turns. When the current in coil B decreases at the rate of 50 ampere per second, the induced emf in A will be
a. 3.14×10^{-6} V
b. 3.14×10^{-4} V
c. 6.28×10^{-4} V
d. 3.14 V

85. For a resistance R and capacitance C in series the impedance is twice that of a parallel combination of the same elements. The frequency of the applied emf, should be
a. $\frac{2\pi}{RC}$
b. $\frac{1}{2\pi RC}$
c. $\frac{2\pi}{\sqrt{RC}}$
d. $2\pi\sqrt{RC}$

86. An AC circuit contains inductance, capacitance and resistance. If V_L, V_C and V_R are the effective voltage across the inductor, capacitor and resistor respectively, then the total effective voltage is
a. $V_R + V_L + V_C$
b. $V_R + V_L - V_C$
c. $\sqrt{V_R^2+(V_L-V_C)^2}$
d. $\sqrt{V_R^2-(V_L-V_C)^2}$

87. An LCR circuit contains a varying emf $\varepsilon = \varepsilon_m \cos \omega t$. At resonance, the amplitude of the oscillating current is solely determined in terms of, ε_m and
a. R
b. L and C
c. L and R
d. C and R

88. In the circuit shown in the given figure, the current i_1 and i_2 flowing through the 3Ω and 6Ω resistors are respectively

a. 3/9 A and 6/9 A
b. 6/9 A and 3/9A
c. 10/11 A and10/14A
d. 10/14 A and 10/11 A

89. A wire carrying a 30 A current has a length of 1 2 cm between the pole pieces of a magnet at an angle of 60° with respect to the field direction. If the magnetic field has a uniform value of 0.90 T, then the force on the wire will he
a. 208 N
b. 28 N
c. 2.8 N
d. 0.25 N

90. A current i is set up in a n-type semiconductor which is placed in a uniform magnetic field B. When i and B are directed along positive X axis and positive Z axis respectively. The hall electric field E will be established along the
a. Positive Y axis
b. negative Y axis
c. negative Z axis
d. positive Z axis

91. The Thomson coefficient thermocouple is of the One junction of a thermocouple is at 0°C while the other junction is at t°C. The

emf of this thermocouple is given by $\varepsilon = at\ l/2bt^2$

The Thomson coefficient of the thermocouple is

a. b(t + 23)
b. bt
c. a(t + 273)
d. at

92. The emf of a thermocouple, with one junction at 0°C and the other at a temperature t^0C is given by $\varepsilon = [50t - 12000\ (1-e^{-0.002t})]\ \mu V$. The Peltier coefficient at 0.C will be

a. 0.71 mV
b. 7.1 mV
c. 7.1/emV
d. 71 mV

93. The velocity of electromagnetic waves in a dielectric medium having permittivity ε and permeability μ is given by

a. $1/\sqrt{\varepsilon\mu}$
b. $\sqrt{\varepsilon/\mu}$
c. $\sqrt{\mu/\varepsilon}$
d. $\sqrt{\varepsilon\mu}$

94. Consider the following statements: In an electromagnetic field

1. The electric field vector is normal to the direction of propagation
2. The magnetic field vector is normal to the direction of propagation
3. Electric field is normal and magnetic field is parallel to the direction of propagation
4. Magnetic field is normal and electric field is parallel to the direction of propagation

Of these statements

a. 1 and 2 are correct
b. 2 and 3 are correct
c. 3 and 4 are correct
d. 1 and 3 are correct

95. A particle of charge e' and mass 'm' moves with a velocity v' in a magnetic field B' applied perpendicular to its motion. The radius r' of its path in the field is

a. r = mv/Be
b. r = Be/mv
c. r = ev/mB
d. r = vB/me

96. Protons are accelerated by a cyclotron in which the magnetic field is 1 .5T. The number of times the potential across the dees reverses in 1 sec should be nearly

a. 2.3×10^7
b. 4.6×10^7
c. 6.5×10^7
d. 8.7×10^7

97. Consider the following statements

Assertion (A): A beam containing α and β particles moving with the same velocity is subjected to a magnetic field perpendicular to their direction of motion. The radius of circular path on which the α particle β particle.

Reason (R): The mass of the α particle is several orders of magnitude higher than that of β particle and its charge is two times that of β particle.

Of these statements

a. Both A and R are true and R is the correct explanation of A
b. Both A and R are true but R is not a correct explanation of A
c. A is true but R is false
d. A is false but R is true

98. Rutherford's experiment on the atom demonstrated

a. the presence of neutrons inside an atom
b. the approximate size of the atom
c. the approximate size of a nucleus
d. the revolving of electron in atomic orbits

99. How many states are completely spherically symmetric when the electron is in the nth excited state where n is the principal quantum number?

a. 2
b. $2n^2$
c. $2n^2$-l
d. $2(n^2-1)$

100. Consider the following statements associated with the production of X-ray spectrum

1. The continuous X-ray spectrum is due to bremsstrahlung
2. The characteristic sharp lines appearing in the spectrum depend on the nature of the target material
3. The X-ray spectrum is due to the rearrangement of nucleons

Of these statements

a. 1and 2 are correct
b. 1 and 3 are correct
c. 2 alone is correct

d. 1, 2 and 3 are correct

101. The radius of the first orbit of hydrogen atom is 5.29×10^{-11} m. The radius of the
a. 1.32×10^{-11} m
b. 10.58×10^{-11} m
c. 15.87×10^{-11} m
d. 21.16×10^{-11} m

102. Match List I with List II and select the correct answer using the codes given below the lists
List I
(Quantum jumps in Hydrogen atom)
A. n = 2 to n = 1
B. n = 3 to n = 2
C. n = 4 to n = 3
D. n = 5 to n = 4
List II
(Name of Series)
1. Balmer
2. Lyman
3. Pasehen
4. Brackett
5. Pfund
Codes:

	A	B	C	D
a.	2	1	3	5
b.	1	2	3	4
c.	2	1	4	5
d.	2	1	3	4

103. Which one of the following statements regarding photo-emission of electrons is correct?
a. Kinetic energy of electrons increases with the intensity of incident light
b. Electrons are emitted when the wavelength of the incident light is above a certain threshold
c. Photoelectric emission is instantaneous with the incidence of light
d. Photoelectrons are emitted whenever a metal is irradiated with ultraviolet light

104. The quantity h/m_0c, with m_0 as the electron mass, has the dimensions of
a. length
b. time
c. mass
d. temperature

105. The value of wavelength of a beam of 150 volt electrons is
a. 0.5 A^0
b. 1.0 A^0
c. 1.5 A^0
d. 15.0 A^0

106. Which of the following statements are true regarding carbon-dating?
1. It employs carbon-14
2. In any living biological system, ratio of carbon- 12 to carbon-14 changes with aging
3. Once a plant or animal is dead, the ratio of carbon- 12 to carbon- 14 becomes constant
4. Some atoms of carbon-13 present in air transform into carbon-14 by absorbing neutrons present in the cosmic rays

Select the correct answer using the codes given below:
Codes:
a. 1, 2, 3 and 4
b. 1 and 4
c. 1, 2 and 3
d. 4 alone

107. $^{238}_{92}U$ undergoes successively eight α decays and six β decays. What is the resulting nucleus?
a. $^{?}Pb$
b. $^{206}_{82}Pb$
c. $^{210}_{82}Pb$
d. $^{214}_{82}Pb$

108. Consider the following statements
Assertion (A): An isolated radioactive atom may not decay at all whatever be its half-life
Reason (R): Radioactive decay is a statistical phenomenon
Of these statements
a. Both A and R are true and R is the correct explanation of A
b. Both A and R are true but R is not a correct explanation of A
c. A is true but R is false
d. A is false but R is true

109. Forces binding neutrons and protons
a. very inversely as r^2
b. very inversely as r^4
c. act upto a certain point and then become zero
d. are responsible for the energy released during nuclear fission

110. The energy of 1.6 Joule is equal to
a. 10^{19} MeV
b. 10^{13} MeV
c. 10^{6} MeV
d. 1.0 MeV

111. Which of the following pairs are correctly matched?
1. Nuclear fission for power generation U-238
2. Nuclear fission ..... Deuterium
3. Nuclear pile .... Core of a nuclear reactor

Select the correct answer using the codes given below
Code:
a. 1, 2 and 3
b. 1 and 2
c. 1 and 3
d. 2 and 3

112. The thermonuclear fusion of hydrogen inside the stars is taking place by a cycle of operations. The particular element which acts as a catalyst, is
a. nitrogen
b. oxygen
c. carbon
d. helium

113. Arrange the following fundamental forces of nature in increasing order of their magnitude
1. Weak
2. Strong
3. Gravitational
4. Electromagnetic

Select the correct answer using the codes given below
Code:
a. 3, 2, 4, 1
b. 3, 1, 4, 2
c. 2, 1, 3, 4
d. 2, 1, 4, 3

114. Which of the following are true in case of negative feedback amplifiers?
1. Stability of the amplifier decreases
2. Distortion in the amplifier decreases
3. Noise in the amplifier decreases
4. Band width of the amplifier decreases

Select the correct answer using the codes given below
Code:
a. 1, 2 and 3
b. 1, 2 and 4
c. 1, 3 and 4
d. 2, 3 and 4

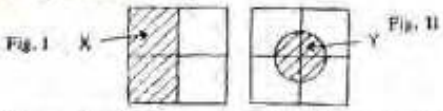
115. The avalanche breakdown in p-n junction is due to
a. shift to Fermi level
b. cumulative effect of conduction brand electron collision
c. widening of forbidden gap
d. high impurity concentration

116. If the plate resistance of a triode is 3.3 x 10^8 ohms and its mutual conductance is 3 x 10^{-3} ohms, then the amplification factor is very nearly equal to
a. 10^0
b. 10^1
c. 10^3
d. 10^6

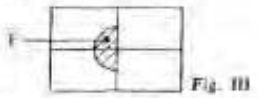
117. A p-n diode is reverse biased. The resistance measured by an ohm meter connected across it will be
a. zero
b. low
c. high
d. infinite

118. A transistor operating in a common-base configuration has a forward current gain factor of 0.99. If the emitter current changes by 1 mA, then the change in the base current will be
a. 100 μA
b. 0.01 mA
c. 0.99 mA
d. 99 mA

119. X and Y in Fig. I and II represent two sets(shaded area)



The output represented by the set, F in Fig. III



Is realized by the logic gate
a. OR
b. NOT
c. NOR
d. AND

120. An OR gale has two inputs X and Y. The correct symbol of the gale is
a.

b.

c.

d.