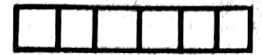


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







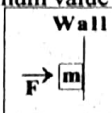
ACHIEVEMENT TEST - 2023 - 2024



PHYSICS

Marks : 100

Time : 1.30 Hrs

- One of the combinations from the fundamental physical constants is, hc/G the unit of this expression is
a) kg^2 b) m^3 c) s^{-1} d) m
- If the error in the measurement of radius is 2%, then the error in the determination of volume of the sphere will be
a) 8% b) 2% c) 4% d) 6%
- If the length and time period of an oscillating pendulum have errors of 1% and 3% respectively then the error in measurement of acceleration due to gravity is
a) 4% b) 5% c) 6% d) 7%
- The length of a body is measured as 3.51 m, if the accuracy is 0.01 m then the percentage error in the measurement is
a) 351% b) 1% c) 0.28% d) 0.035%
- If $\pi = 3.14$, then the value of π^2 is
a) 9.8596 b) 9.860 c) 9.86 d) 9.9
- The dimensional formula of Planck's constant h is
a) $[\text{ML}^2\text{T}^{-1}]$ b) $[\text{ML}^2\text{T}^{-3}]$ c) $[\text{MLT}^{-1}]$ d) $[\text{ML}^3 \text{T}^3]$
- The velocity of a particle v at an instant t is given by $v = at + bt^2$. The dimensions of b is
a) $[\text{L}]$ b) $[\text{LT}^{-1}]$ c) $[\text{LT}^{-2}]$ d) $[\text{LT}^{-3}]$
- The dimensional formula for gravitational constant G is
a) $[\text{ML}^3\text{T}^{-2}]$ b) $[\text{M}^{-1} \text{L}^3\text{T}^{-2}]$ c) $[\text{M}^{-1}\text{L}^{-3}\text{T}^{-2}]$ d) $[\text{ML}^{-3}\text{T}^2]$
- Which one of the following Cartesian coordinate systems is not followed in physics?
a)  b)  c)  d) 
- Identify the unit vector in the following.
a) $\hat{i} + \hat{j}$ b) $\frac{i}{\sqrt{2}}$ c) $\frac{k-j}{\sqrt{2}}$ d) $\frac{i+j}{\sqrt{2}}$
- Which one of the following physical quantities cannot be represented by a scalar?
a) Mass (b) length (c) momentum (d) magnitude of acceleration
- Two objects of masses m_1 and m_2 fall from the heights h_1 and h_2 respectively. The ratio of the magnitude of their momenta when they hit the ground is
a) $\frac{\sqrt{h_1}}{h_2}$ b) $\frac{\sqrt{m_1 h_1}}{m_2 h_2}$ c) $\frac{m_1}{m_2} \frac{\sqrt{h_1}}{h_2}$ d) $\frac{m_1}{m_2}$
- If a particle has negative velocity and negative acceleration, its speed
(a) increases (b) decreases (c) remains same (d) zero
- If the velocity is $v = 2i + t j - 9k$, then the magnitude of acceleration at $t = 0.5$ s is
(a) 1 m s^{-2} (b) 2 m s^{-2} (c) zero (d) -1 m s^{-2}
- If an object is dropped from the top of a building and it reaches the ground at $t = 4$ s then the height of the building is (ignoring air resistance) ($g = 9.8 \text{ ms}^{-2}$)
a) 77.3 m (b) 78.4 m (c) 80.5 m d) 79.2 m
- A ball is projected vertically upwards with a velocity v . It comes back to ground in time t . Which v - t graph shows the motion correctly?
a)  b)  c)  d) 
- If one object is dropped vertically downward and another object is thrown horizontally from the same height, then the ratio of vertical distance covered by both objects at any instant t is
a) 1 b) 2 c) 4 d) 0.5
- If an object is thrown vertically up with the initial speed u from the ground, then the time taken by the object to return back to ground is
a) $u^2/2g$ b) u^2/g c) $u/2g$ d) $2u/g$
- When a car takes a sudden left turn in the curved road, passengers are pushed towards the right due to
a) inertia of direction b) inertia of motion c) inertia of rest d) absence of inertia
- An object of mass m held against a vertical wall by applying horizontal force F as shown in the figure. The minimum value of the force F is
a) Less than mg b) Equal to mg c) Greater than mg d) Cannot determine

- A vehicle is moving along the positive x direction, if sudden brake is applied, then
(a) frictional force acting on the vehicle is along negative x direction
(b) frictional force acting on the vehicle is along positive x direction
(c) no frictional force acts on the vehicle (d) frictional force acts in downward direction
- Two masses m_1 and m_2 are experiencing the same force where $m_1 < m_2$. The ratio of their acceleration a_1/a_2 is
a) 1 b) less than 1 c) greater than 1 d) all the three cases
- Force acting on the particle moving with constant speed is
(a) always zero (b) need not be zero (c) always non zero (d) cannot be concluded
- An object of mass m begins to move on the plane inclined at an angle θ . The coefficient of static friction of inclined surface is μ_s . The maximum static friction experienced by the mass is
(a) mg (b) $\mu_s mg$ (c) $\mu_s mg \sin \theta$ (d) $\mu_s mg \cos \theta$

25. When the object is moving at constant velocity on the rough surface,
 (a) net force on the object is zero (b) no force acts on the object
 (c) only external force acts on the object (d) only kinetic friction acts on the object
26. If a person moving from pole to equator, the centrifugal force acting on him
 (a) increases (b) decreases (c) remains the same (d) increases and then decreases
27. A uniform force of $(2\hat{i} + \hat{j})$ N acts on a particle of mass 1 kg. The particle displaces from position $(3\hat{j} + \hat{k})$ m to $(5\hat{i} + \hat{j})$ m. The work done by the force on the particle is
 a) 9J (b) 6J (c) 10J (d) 12J
28. A ball of mass 1 kg and another of mass 2 kg are dropped from a tall building whose height is 80 m. After a fall of 40 m each towards Earth, their respective kinetic energies will be in the ratio of
 a) $\sqrt{2} : 1$ (b) $1 : \sqrt{2}$ (c) 2 : 1 (d) 1 : 2
29. A body of mass 1 kg is thrown upwards with a velocity 20 ms^{-1} . It momentarily comes to rest after attaining a height of 18 m. How much energy is lost due to air friction? (Take $g = 10 \text{ ms}^{-2}$)
 a) 20 J (b) 30 J (c) 40 J (d) 10 J
30. An engine pumps water continuously through a hose. Water leaves the hose with a velocity v and m is the mass per unit length of the water of the jet. What is the rate at which kinetic energy is imparted to water?
 a) $1/2 mv^3$ (b) mv^3 (c) $3/2 mv^2$ (d) $5/2 mv^2$
31. The potential energy of a system increases, if work is done
 (a) by the system against a conservative force (b) by the system against a non-conservative force
 (c) upon the system by a conservative force (d) upon the system by a non-conservative force
32. What is the minimum velocity with which a body of mass m must enter a vertical loop of radius R so that it can complete the loop?
 a) $\sqrt{2gR}$ (b) $\sqrt{3gR}$ (c) $\sqrt{5gR}$ (d) \sqrt{gR}
33. The work done by the conservative force for a closed path is
 (a) always negative (b) zero (c) always positive (d) not defined
34. If the linear momentum of the object is increased by 0.1%, then the kinetic energy is increased by
 (a) 0.1% (b) 0.2% (c) 0.4% (d) 0.01%
35. The centre of mass of a system of particles does not depend upon,
 (a) position of particles (b) relative distance between particles (c) masses of particles (d) force acting on particle
36. A couple produces,
 (a) pure rotation (b) pure translation (c) rotation and translation (d) no motion
37. A rope is wound around a hollow cylinder of mass 3 kg and radius 40 cm. What is the angular acceleration of the cylinder if the rope is pulled with a force 30 N?
 (a) 0.25 rad s^{-2} (b) 25 rad s^{-2} (c) 5 ms^{-2} (d) 25 ms^{-2}
38. A closed cylindrical container is partially filled with water. As the container rotates in a horizontal plane about a perpendicular bisector, its moment of inertia,
 (a) increases (b) decreases (c) remains constant (d) depends on direction of rotation.
39. A rigid body rotates with an angular momentum L . If its kinetic energy is halved, the angular momentum becomes,
 (a) L (b) $L/2$ (c) $2L$ (d) $L/\sqrt{2}$
40. The ratio of the acceleration for a solid sphere (mass m and radius R) rolling down an incline of angle θ without slipping and slipping down the incline without rolling is,
 a) 5:7 (b) 2:3 (c) 2:5 (d) 7:5
41. From a disc of radius R a mass M , a circular hole of diameter R , whose rim passes through the centre is cut. What is the moment of inertia of the remaining part of the disc about a perpendicular axis passing through it
 a) $15MR^2/32$ (b) $13MR^2/32$ (c) $11MR^2/32$ (d) $9MR^2/32$
42. The speed of a solid sphere after rolling down from rest without sliding on an inclined plane of vertical height h is.
 a) $\sqrt{4/3 gh}$ (b) $\sqrt{10/7 gh}$ (c) $\sqrt{2gh}$ (d) $\sqrt{1/2 gh}$
43. The linear momentum and position vector of the planet is perpendicular to each other at
 (a) perihelion and aphelion (b) at all points (c) only at perihelion (d) no point
44. If the masses of the Earth and Sun suddenly double, the gravitational force between them will
 (a) remain the same (b) increase 2 times (c) increase 4 times (d) decrease 2 times
45. A planet moving along an elliptical orbit is closest to the Sun at distance r_1 and farthest away at a distance of r_2 . If v_1 and v_2 are linear speeds at these points respectively. Then the ratio v_1 / v_2 is
 a) r_2/r_1 (b) $(r_2/r_1)^2$ (c) r_1/r_2 (d) $(r_1/r_2)^2$
46. The time period of a satellite orbiting Earth in a circular orbit is independent of
 a) Radius of the orbit (b) The mass of the satellite (c) Both the mass and radius of the orbit
 d) Neither the mass nor the radius of its orbit
47. According to Kepler's second law, the radial vector to a planet from the Sun sweeps out equal areas in equal intervals of time. This law is a consequence of
 (a) conservation of linear momentum (b) conservation of angular momentum
 (c) conservation of energy (d) conservation of kinetic energy
48. The gravitational potential energy of the Moon with respect to Earth is
 (a) always positive (b) always negative (c) can be positive or negative (d) always zero
49. The work done by the Sun's gravitational force on the Earth is
 (a) always zero (b) always positive (c) can be positive or negative (d) always negative

50. If the mass and radius of the Earth are both doubled, then the acceleration due to gravity g
 (a) remains same (b) $g/2$ (c) $2g$ (d) $4g$
51. If a person moves from Chennai to Trichy, his weight
 (a) increases (b) decreases (c) remains same (d) increases and then decreases
52. If the acceleration due to gravity becomes 4 times its original value, then escape speed
 (a) remains same (b) 2 times of original value (c) becomes halved (d) 4 times of original value
53. If a wire is stretched to double of its original length, then the strain in the wire is
 (a) 1 (b) 2 (c) 3 (d) 4
54. For a given material, the rigidity modulus is $(1/3)^{th}$ of Young's modulus. Its Poisson's ratio is
 (a) 0 (b) 0.25 (c) 0.3 (d) 0.5
55. A small sphere of radius 2 cm falls from rest in a viscous liquid. Heat is produced due to viscous force. The rate of production of heat when the sphere attains its terminal velocity is proportional to
 (a) 2^2 (b) 2^3 (c) 2^4 (d) 2^5
56. Two wires are made of the same material and have the same volume. The area of cross sections of the first and the second wires are A and $2A$ respectively. If the length of the first wire is increased by Δl on applying a force F , how much force is needed to stretch the second wire by the same amount?
 (a) $2F$ (b) $4F$ (c) $8F$ (d) $16F$
57. With an increase in temperature, the viscosity of liquid and gas, respectively will
 (a) increase and increase (b) increase and decrease (c) decrease and increase (d) decrease and decrease
58. The Young's modulus for a perfect rigid body is
 (a) 0 (b) 1 (c) 0.5 (d) infinity
59. Which of the following is not a scalar?
 (a) viscosity (b) surface tension (c) pressure (d) stress
60. If the temperature of the wire is increased, then the Young's modulus will
 (a) remain the same (b) decrease (c) increase rapidly (d) increase by very a small amount
61. The wettability of a surface by a liquid depends primarily on
 (a) viscosity (b) surface tension (c) density (d) angle of contact between the surface and the liquid
62. In a horizontal pipe of non-uniform cross section, water flows with a velocity of ms^{-1} at a point where the diameter of the pipe is 20 cm. The velocity of water ($1.5 m s^{-1}$) at a point where the diameter of the pipe is (in cm)
 (a) 8 (b) 16 (c) 24 (d) 32
63. In hot summer after a bath, the body's
 a) internal energy decreases (b) internal energy increases
 c) heat decreases (d) no change in internal energy and heat
64. The graph between volume and temperature in Charles' law is
 a) an ellipse (b) a circle (c) a straight line (d) a parabola
65. When a cycle tyre suddenly bursts, the air inside the tyre expands. This process is
 a) isothermal (b) adiabatic (c) isobaric (d) isochoric
66. An ideal gas passes from one equilibrium state (P_1, V_1, T_1, N) to another equilibrium state ($2P_1, 3V_1, T_2, N$). Then
 a) $T_1 = T_2$ (b) $T_1 = T_2/6$ (c) $T_1 = 6T_2$ (d) $T_1 = 3T_2$
67. When a uniform rod is heated, which of the following quantity of the rod will increase
 a) mass (b) weight (c) center of mass (d) moment of inertia
68. When you exercise in the morning by considering your body as thermodynamic system, which of the following is true?
 a) $\Delta U > 0, W > 0$, (b) $\Delta U < 0, W > 0$, (c) $\Delta U < 0, W < 0$, (d) $\Delta U = 0, W > 0$,
69. A distant star emits radiation with maximum intensity at 350 nm. The temperature of the star is
 a) 8280 K (b) 5000 K (c) 7260 K (d) 9044 K
70. Identify the state variables given here?
 a) Q, T, W (b) P, T, U (c) Q, W (d) P, T, Q
71. In an isochoric process, we have
 a) $w=0$ (b) $Q=0$ (c) $\Delta U=0$ (d) $\Delta T=0$
72. The efficiency of a heat engine working between the freezing point and boiling point of water is
 a) 6.25% (b) 20% (c) 26.8% (d) 12.5%
73. A sample of ideal gas is at equilibrium. Which of the following quantity is zero?
 (a) rms speed (b) average speed (c) average velocity (d) most probable speed
74. Two identically sized rooms A and B are connected by an open door. If the room A is air conditioned such that its temperature is $4^\circ C$ lesser than room B, which room has more air in it?
 (a) Room A (b) Room B (c) Both room has same air (d) Cannot be determined
75. The average translational kinetic energy of gas molecules depends on
 (a) number of moles and T (b) only on T (c) P and T (d) P only
76. If the internal energy of an ideal gas U and volume V are doubled then the pressure
 (a) doubles (b) remains same (c) halves (d) quadruples
77. The ratio $\gamma = C_p / C_v$ for a gas mixture consisting of 8 g of helium and 16 g of oxygen is
 a) 23/15 (b) 15/23 (c) 27/17 (d) 17/27
78. A container has one mole of monoatomic ideal gas. Each molecule has f degrees of freedom. What is the ratio of $\gamma = C_p / C_v$
 a) f (b) $f/2$ (c) $f/f+2$ (d) $f+2/f$
79. If the temperature and pressure of a gas is doubled the mean free path of the gas molecules
 (a) remains same (b) doubled (c) tripled (d) quadrupled

80. Which of the following gases will have least rms speed at a given temperature?
 (a) Hydrogen (b) Nitrogen (c) Oxygen (d) Carbon dioxide
81. In a simple harmonic oscillation, the acceleration against displacement for one complete oscillation will be
 a) an ellipse b) a circle c) a parabola d) a straight line
82. A particle executing SHM crosses points A and B with the same velocity. Having taken 3 s in passing from A to B, it returns to B after another 3 s. The time period is
 a) 15s b) 6s c) 12s d) 9s
83. The length of a second's pendulum on the surface of the Earth is 0.9 m. The length of the same pendulum on surface of planet X such that the acceleration of the planet X is n times greater than the Earth is
 a) $0.9n$ b) $0.9/n$ m c) $0.9n^2$ m d) $0.9/n^2$
84. Two bodies A and B whose masses are in the ratio 1:2 are suspended from two separate massless springs of force constants k_A and k_B respectively. If the two bodies oscillate vertically such that their maximum velocities are in the ratio 1:2, the ratio of the amplitude A to that of B is
 a) $\sqrt{k_B/2k_A}$ b) $\sqrt{k_B/8k_A}$ c) $\sqrt{2k_B/k_A}$ d) $\sqrt{8k_B/k_A}$
85. A spring is connected to a mass m suspended from it and its time period for vertical oscillation is T . The spring is now cut into two equal halves and the same mass is suspended from one of the halves. The period of vertical oscillation is
 a) $T' = \sqrt{2}T$ b) $T' = T/\sqrt{2}$ c) $T' = \sqrt{2}T$ d) $T' = \sqrt{T/2}$
86. A pendulum is hung in a very high building oscillates to and fro motion freely like a simple harmonic oscillator. If the acceleration of the bob is 16 ms^{-2} at a distance of 4 m from the mean position, then the time period is
 a) 2 s b) 1 s c) 2π s d) π s
87. A hollow sphere is filled with water. It is hung by a long thread. As the water flows out of a hole at the bottom, the period of oscillation will
 a) first increase and then decrease b) first decrease and then increase
 c) increase continuously d) decrease continuously
88. The damping force on an oscillator is directly proportional to the velocity. The units of the constant of proportionality are
 a) kg ms^{-1} b) kg ms^{-2} c) kg s^{-1} d) kg s
89. Let the total energy of a particle executing simple harmonic motion with angular frequency is 1 rads^{-1} is 0.256J. If the displacement of the particle at time $t = \pi/2$ s is $8\sqrt{2}$ cm then the amplitude of motion is
 a) 8cm b) 6cm c) 32cm d) 64cm
90. A mass of 3kg is attached at the end of a spring moves with simple harmonic motion on a horizontal frictionless table with time period 2π and with amplitude of 2m, then the maximum force exerted on the spring is
 a) .5N b) 3N c) 6 N d) 2 N
91. A student tunes his guitar by striking a 120 Hertz with a tuning fork, and simultaneously plays the 4th string on his guitar. By keen observation, he hears the amplitude of the combined sound oscillating thrice per second. Which of the following frequencies is the most likely the frequency of the 4th string on his guitar?
 a) 130 b) 117 c) 110 d) 120
92. A transverse wave moves from a medium A to a medium B. In medium A, the velocity of the transverse wave is 500 ms^{-1} and the wavelength is 5 m. The frequency and the wavelength of the wave in medium B when its velocity is 600 ms^{-1} , respectively are
 a) 120 Hz and 5 m b) 100 Hz and 5 m c) 120 Hz and 6 m d) 100 Hz and 6 m
93. For a particular tube, among six harmonic frequencies below 1000 Hz only four harmonic frequencies are given: 300 Hz, 600 Hz, 750 Hz and 900 Hz. What are the two other frequencies missing from this list?
 a) 100 Hz, 150 Hz b) 150 Hz, 450 Hz c) 450 Hz, 700 Hz d) 700 Hz, 800 Hz
94. Equation of travelling wave on a stretched string of linear density 5g/m is $y = 0.03 \sin(450t - 9x)$, Where distance and time are measured in SI units. The tension in the string is
 a) 5N b) 12.5N c) 7.5N d) 10 N
95. A sound wave whose frequency is 5000 Hz travels in air and then hits the water surface. The ratio of its wavelengths in water and air is
 a) 4.30 b) 0.23 c) 5.30 d) 1.23
96. A person standing between two parallel hills fires a gun and hears the first echo after t_1 sec and the second echo after t_2 sec. The distance between the two hills is
 a) $v(t_1 - t_2) / 2$ b) $v(t_1 t_2) / 2 (t_1 + t_2)$ c) $v(t_1 + t_2)$ d) $v(t_1 + t_2) / 2$
97. An air column in a pipe which is closed at one end, will be in resonance with the vibrating body of frequency 83 Hz. Then the length of the air column is
 (a) 1.5 m (b) 0.5 m (c) 1.0 m (d) 2.0 m
98. The displacement y of a wave travelling in the direction is given by $y = (2 \times 10^{-3}) \sin(300t - 2x + \pi/4)$ where x and y are measured in metres and t , in second. The speed of the wave is
 (a) 150 ms^{-1} (b) 300 ms^{-1} (c) 450 ms^{-1} (d) 600 ms^{-1}
99. Which of the following represents a wave
 (a) $(x-vt)^3$ (b) $x(x+vt)$ (c) $1/(x+vt)$ (d) $\sin(x+vt)$
100. An organ pipe A closed at one end is allowed to vibrate in its first harmonic and another pipe B open at both ends is allowed to vibrate in its third harmonic. Both A and B are in resonance with a given tuning fork. The ratio of the length of A and B is
 a) 8/3 b) 3/8 c) 1/6 d) 1/3