

PHYSICS QUESTION PAPER

Time : 2 Hrs.

Max. Marks : 40

Q. 1. Select and write the most appropriate answer from the given alternatives for each sub-question : [8]

- (i) The S. I. unit of emissive power is (1)
(a) Watt/m² (b) Watt.m² (c) Watt/m²K (d) Watt.m²/K
- (ii) For two vibrating bodies to be in resonance, which of the following quantity should be equal? (1)
(a) Wavelength (b) Frequency (c) Amplitude (d) Wave-velocity
- (iii) One beat means that the intensity of sound should be (1)
(a) once maximum (b) once minimum
(c) once maximum and once minimum (d) twice maximum and twice minimum
- (iv) The radius of gyration of a solid sphere of mass 'M' and radius 'R' rotating about an axis coinciding with its diameter is (1)
(a) $\sqrt{\frac{1}{5}} \cdot R$ (b) $\sqrt{\frac{2}{5}} \cdot R$ (c) $\sqrt{\frac{3}{5}} \cdot R$ (d) $\sqrt{\frac{7}{5}} \cdot R$
- (v) The weight of body is maximum (1)
(a) at poles of the earth (b) at equator of the earth
(c) below the surface of the earth (d) above the surface of the earth
- (vi) A stone is tied to a string and rotated in horizontal circle with constant angular velocity. If the string is released, the stone flies (1)
(a) radially inward (b) radially outward
(c) tangentially forward (d) tangentially backward
- (vii) The maximum velocity of a particle performing linear S.H.M. is 0.32 m/s and its maximum acceleration is 2.56 m/s², the amplitude of S.H.M. is (1)
(a) 0.02 m (b) 0.03 m (c) 0.04 m (d) 0.05 m
- (viii) A force of 100 N produces a change of 0.1% in a length of a wire of area of cross-section 1.0 m². Young's modulus of the wire is (1)
(a) 10⁵ N/m² (b) 10⁹ N/m² (c) 10¹¹ N/m² (d) 10¹² N/m²

Q. 2 (A) Attempt any ONE: [8]

- (i) A metal sphere cools at the rate of 4° C per minute at the temperature of 60° C. Calculate the rate of cooling at 40° C if temperature of surroundings is 30° C. (2)
- (ii) A torque of magnitude 1000 Nm acting on a body, produces an angular acceleration of 2rad/s². Calculate the moment of inertia of the body. (2)

(B) Attempt any TWO :

- (i) Draw neat diagrams of the parallel and perpendicular positions of the turning fork in Melde's experiment for the same length and same tension with the formation of the loops and write the formula for the frequency of the vibrating tuning fork in each position. (3)
- (ii) Derive the expression for the strain energy. Hence show that strain energy per unit volume is directly proportional to square of the stress. (3)
- (iii) Obtain an expression for maximum speed with which a vehicle can be driven safely on a banked road. Show that the safety speed limit is independent of the mass of the vehicle. (3)

Q. 3 (A) Attempt any ONE : [8]

- (i) Define angular S.H.M. State its differential equation. (2)
- (ii) State 'any four' assumptions of Kinetic theory of gases. (2)

(B) Attempt any TWO :

- (i) State and prove the principle of perpendicular axes. (3)

(ii) Define: (1) Coefficient of absorption. (2) Coefficient of reflection. (3) Coefficient of transmission and obtain the relation between them. (3)

(iii) Show that only odd harmonics are present in the vibrations of the air column in a pipe closed at one end. (3)

Q. 4 (A) Attempt any TWO : [8]

(i) Draw a neat diagram for the rise of liquid in a capillary tube showing the components of a surface tension T . (2)

(ii) Distinguish between Centripetal and Centrifugal force. (2)

(iii) Draw a neat labelled diagram of Searle's apparatus to determine Young's modulus. (2)

(B) Attempt any ONE :

(i) Define an ideal simple pendulum. Show that the motion of a simple pendulum under certain conditions is simple harmonic. Obtain an expression for its period. (4)

(ii) On the basis of the kinetic theory of gases, derive an expression for the pressure exerted by a gas. (4)

Q. 5 (A) (a) Attempt any TWO : [8]

(i) At what distance above the earth's surface and at what depth below the earth's surface, is the acceleration due to gravity less by 10% of its value at the surface ?

(Given : Radius of the earth = 6400 km.) (4)

(ii) Calculate the work done when a spherical drop of mercury of radius 2mm, falls from some height and breaks into a million droplets, each of the same size. The surface tension of mercury is $T = 0.5 \text{ N/m}$. (4)

(iii) A simple harmonic progressive wave is given by the equation, $Y = 0.1 \sin 4\pi(50t - 0.1x)$ in S.I. units. Find the amplitude, frequency, wavelength and velocity of the wave. (4)