

PHYSICS QUESTION PAPER

Time : 2 Hrs.

Max. Marks : 40

Note :

- (i) All questions are compulsory.
- (ii) Neat diagrams must be drawn wherever necessary.
- (iii) Figures to the right indicate full marks.
- (iv) Use of only logarithmic table is allowed.
- (v) All symbols have their usual meanings unless otherwise stated.
- (vi) Answer to every question must be written on a new page.

- Q. 1** Select and write the most appropriate answer from the given alternatives for each subquestion. [8]
- (i) The speed of a transverse wave (V) along a stretched string is (1)
- (a) $\sqrt{\frac{T}{m}}$ (b) $\sqrt{\frac{m}{T}}$ (c) $\sqrt{\frac{P}{E}}$ (d) $\sqrt{T \cdot m}$
- (ii) In reflection of sound waves from rarer medium, there is phase change of (1)
- (a) 0 rad (b) $\frac{\pi}{4}$ rad (c) $\frac{\pi}{2}$ rad (d) π rad.
- (iii) The relation between Young's modulus Y , bulk modulus K and the modulus of rigidity η is
- (a) $\frac{3}{K} + \frac{1}{\eta} = \frac{9}{Y}$ (b) $\frac{1}{K} + \frac{3}{\eta} = \frac{3}{Y}$ (c) $\frac{9}{K} + \frac{1}{\eta} = \frac{3}{Y}$ (d) $\frac{1}{K} + \frac{3}{\eta} = \frac{39}{Y}$
- (iv) The total work done by a restoring force in simple harmonic motion of amplitude a and angular velocity ω , in one oscillation is (1)
- (a) $\frac{1}{2} m A^2 \omega^2$ (b) Zero (c) $m A^2 \omega^2$ (d) $\frac{1}{2} m A \omega$
- (v) The dimensions of angular momentum are (1)
- (a) $[M^1 L^{-2} T^{-1}]$ (b) $[M^1 L^2 T^{-1}]$ (c) $[M^2 L^1 T^1]$ (d) $[M^2 L^2 T^{-2}]$
- (vi) The gravitational potential due to the earth is minimum at (1)
- (a) the centre (b) the surface
(c) a distance equal to 100 times the radius of the earth
(d) infinite distance
- (vii) A car is moving along a horizontal curve of radius 20 m, and coefficient of friction between the road and wheels of the car is 0.25. If acceleration due to gravity is 9.8 ms^{-2} , then its maximum speed is (1)
- (a) 3 m/s (b) 5 m/s (c) 7 m/s (d) 9 m/s
- (viii) At what temperature will the R.M. S. velocity of a gas be double its value at N.T.P.? (1)
- (a) 273°C (b) 546°C (c) 81°C (d) 190°C

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

- (i) A 3 m long copper wire is stretched to produce an extension of 0.3 cm. If Poisson's ratio for copper is 0.26, what is the lateral strain produced in the wire? (2)
- (ii) The velocities of three molecules of a gas are 2 ms^{-1} , 3 ms^{-1} and 4 ms^{-1} respectively. Find the mean velocity and R.M. S. velocity of molecules. (2)

(B) Attempt any Two :

- (i) Derive an expression for linear acceleration of a particle performing U. C. M. (3)
- (ii) Two S. H. Ms are represented by $x_1 = a_1 \sin(\omega t + \alpha_1)$ and $x_2 = a_1 \sin(\omega t + \alpha_2)$. Obtain the expressions for the displacement, amplitude and initial phase of the resultant motion. (3)
- (iii) Show that the kinetic energy of a rotating body about a given axis is equal to $\frac{1}{2} L \omega$ where L is angular momentum and ω is angular velocity. (3)

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

Define the terms : (a) Sphere of influence, (b) Angle of contact. (2)

(ii) Draw a neat labelled diagram of Ritchie's experiment of verify the Kirchoff's law of radiation. (2)

(B) Attempt any Two :

(i) Explain internal and external latent heat.

How are they related to each other ? (3)

(ii) Represent graphically the displacement, velocity and acceleration against time for a particle performing linear S. H. M., when it starts from the mean position. (3)

(iii) Describe Searle's method to determine the Young modulus of material of a wire. (3)

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

(i) Obtain the relation between linear velocity and angular velocity in U. C. M. (2)

(ii) Define Radius of gyration. Explain its physical significance. (2)

(iii) Draw a neat diagram of the first two modes of vibrations of string stretched between two rigid supports. (2)

(B) Attempt any One :

(i) Discuss the variation of 'g' with depth and derive the necessary formula. (4)

(ii) Explain the phenomenon of surface tension on the basis of molecular theory. (4)

Q.5 Attempt any Two : [8]

(i) A heated metal ball is placed in cooler surroundings. Its rate of cooling is 2°C per minute when its temperature is 60°C and 1.2°C per minute when its temperature is 52°C . Determine the temperature of the surroundings and the rate of cooling when the temperature of the ball is 48°C . Also find the temperature at which, rate of cooling is 0.6°C per minute. (4)

(ii) The velocity of sound in air at room temperature is 350 m/s . An air column is 35 cm in length. Find the frequency of the third overtone in a pipe when it is (a) closed at one end, (b) open at both ends. (4)

(iii) Wavelengths of two notes in air are $\frac{83}{170}\text{ m}$ and $\frac{83}{172}\text{ m}$. Each of these notes produce 4 beats per second with a third note of a fixed frequency. Find the velocity of sound in air. (4)