

# 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.

- (i) A body performing uniform circular motion has ..... (1)  
(a) constant velocity (b) constant acceleration  
(c) constant kinetic energy (d) constant displacement
- (ii) The time period 'T' of the artificial satellite of earth depends on the average density 'ρ' of the earth as ..... (1)  
(a)  $T \propto \rho$  (b)  $T \propto \sqrt{\rho}$  (c)  $T \propto \frac{1}{\sqrt{\rho}}$  (d)  $T \propto \frac{1}{\rho}$
- (iii) In simple harmonic motion, acceleration of the particle is zero, when its ..... (1)  
(a) velocity is zero (b) displacement is zero  
(c) both velocity and displacement are zero  
(d) both velocity and displacement are maximum.
- (iv) Strain energy per unit volume is given by ..... (1)  
(a)  $\frac{1}{2} \frac{(\text{stress})^2}{Y}$  (b)  $\frac{1}{2} (\text{stress})^2 \cdot Y$  (c)  $\frac{1}{2} \frac{Y}{(\text{stress})^2}$  (d)  $\frac{1}{2} \frac{(\text{strain})^2}{Y}$
- (v) In open organ pipe, first overtone produced is of such frequency that length of the pipe is equal to ..... (1)  
(a)  $\frac{\lambda}{4}$  (b)  $\frac{\lambda}{3}$  (c)  $\frac{\lambda}{2}$  (d)  $\lambda$
- (vi) For athermanous surface ..... (1)  
(a)  $r = 1$  (b)  $a = 1$  (c)  $t = 0$  (d)  $t = 1$ .
- (vii) A body is acted upon by a constant torque. In 4 seconds its angular momentum changes from L to 4 L. The magnitude of the torque is ..... (1)  
(a) (b)  $\frac{3L}{4}$  (c) 3 L (d) 12 L
- (viii) A vibrating tuning fork emits sound waves of period  $2 \times 10^{-3}$  second and wavelength 0.7 m in air. The velocity of sound in air is ..... (1)  
(a) 175 m/s (b) 330 m/s (c) 340 m/s (d) 350 m/s

**Q. 2 (A) Attempt any One :**

- (i) When the pressure applied to one litre of a liquid is increased by  $2 \times 10^6$  N/m<sup>2</sup> its volume decreases by  $10^{-6}$  m<sup>3</sup>. Find the bulk modulus of the liquid. (2)
- (ii) An object of mass 1 kg is tied to one end of a string of length 9 m and whirled in a vertical circle. What is minimum speed required at the lowest position to complete a circle? (Acceleration due to gravity = 9.8 m/s<sup>2</sup>) (2)

**(B) Attempt any Two :**

- (i) Define surface tension. Explain the effect of impurity on surface tension. (3)
- (ii) What is perfectly black body? Draw a neat labelled diagram of artificial perfectly black body. (3)
- (iii) Derive an expression for moment of inertia of a thin uniform rod about an axis passing through its centre and perpendicular to its length.

**Q. 3 (A) Attempt any One :**

- (i) Which specific heat of a gas is greater? Why? (2)
- (ii) Represent graphically the variations of K.E., P.E. and T.E. of a particle performing linear S.H.M. with respect to displacement. (2)

**(B) Attempt any Two :**

- (i) Derive an expression for period of a conical pendulum. (3)
- (ii) With the help of a neat graph, discuss the behaviour of a wire subjected to increasing load. (3)

(iii) What is Surface energy? Obtain relation between surface tension and surface energy. (3)

**Q4 (A) Attempt any Two :**

- (i) Draw neat labelled diagrams of the first two modes of vibrations of an air column open at both ends. (2)
- (ii) Define moment of inertia. State its SI unit and dimensions. (2)
- (iii) Show graphically spectrum of energy distribution of black body in terms of wavelength. (2)
- (B) Attempt any One :**
- (i) What is critical velocity ? Obtain an expression for critical velocity of an orbiting satellite. On what factors does it depend ? (4)
- (ii) What are beats ? Prove that the frequency of beats is equal to the difference between the frequencies of the two sound notes giving rise to beats. (4)

**Q.5 Attempt any Two :**

- (i) The displacement of a particle performing S.H.M. is given by
- $$x = \left[ 5 \sin \pi t + 12 \sin \left( \pi t + \frac{\pi}{2} \right) \right] \text{cm.}$$
- Determine the amplitude, period and initial phase of the motion. (4)
- (ii) In a Melde's experiment when 6 gram weights are added to pan, the number of loops is 5 and when 10.5 gram weights are added to the pan, the number of loops is 4. Find the number of loops when there are no weights in that pan. (4)
- (iii) At normal pressure, 1 kg of ice occupies volume  $1.1 \times 10^{-3} \text{m}^3$ . The volume changes to  $10^{-3} \text{m}^3$  when it is melted. Find the external and internal latent heat of ice. (Latent heat of fusion of ice = 80 k cal/ kg;  $J = 4200 \text{ J/k cal}$  and pressure at N. T.P.  $1.013 \times 10^5 \text{ N/m}^2$ ) (4)