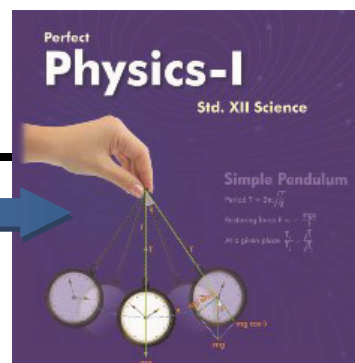


BOARD QUESTION PAPER: MARCH 2014

PHYSICS – I (12th Sci., HSC, Maharashtra)

**Note:**

- All questions are compulsory.
- Neat and well labelled diagrams must be drawn wherever necessary.
- Figures to the right indicate full marks.
- Use of only logarithmic table is allowed.
- All symbols have their usual meaning unless otherwise stated.

This question paper is an extract from our title "Perfect Physics - I" for Std. XII Science, MH Board. Visit www.targetpublications.org to know more

SECTION – I

Q.1. Attempt any SIX :**[12]**

- Explain the rise of liquid in the capillary on the basis of pressure difference.
- Show graphical representation of energy distribution spectrum of perfectly black body.
- The escape velocity of a body from the surface of the earth is 11.2 km/s. If a satellite were to orbit close to the surface, what would be its critical velocity?
- A pipe which is open at both ends is 47 cm long and has an inner diameter 5 cm. If the speed of sound in air is 348 m/s, calculate the fundamental frequency of air column in that pipe.
- Show that R.M.S. velocity of gas molecules is directly proportional to square root of its absolute temperature.
- For a particle performing uniform circular motion $\vec{v} = \vec{\omega} \times \vec{r}$ obtain an expression for linear acceleration of the particle performing non-uniform circular motion.
- A stone of mass 1 kg is whirled in horizontal circle attached at the end of a 1 m long string. If the string makes an angle of 30° with vertical, calculate the centripetal force acting on the stone. ($g = 9.8 \text{ m/s}^2$).
- A solid cylinder of uniform density of radius 2 cm has mass of 50 g. If its length is 12 cm, calculate its moment of inertia about an axis passing through its centre and perpendicular to its length.

Q.2. Attempt any THREE :**[9]**

- Derive an expression for acceleration due to gravity at depth 'd' below the earth's surface.
- A copper metal cube has each side of length 1 m. The bottom edge of the cube is fixed and tangential force $4.2 \times 10^8 \text{ N}$ is applied to a top surface. Calculate the lateral displacement of the top surface if modulus of rigidity of copper is $14 \times 10^{10} \text{ N/m}^2$.
- State an expression for K. E. (kinetic energy) and P. E. (potential energy) at displacement 'x' for a particle performing linear S.H. M. Represent them graphically. Find the displacement at which K. E. is equal to P. E.
- The equation of simple harmonic progressive wave is given by $y = 0.05 \sin \pi \left[20t - \frac{x}{6} \right]$, where all quantities are in S. I. units. Calculate the displacement of a particle at 5 m from origin and at the instant 0.1 second.

- Q.3. A.** State and prove the theorem of 'parallel axes'. [7]
B. Calculate the density of paraffin oil, if glass capillary of diameter 0.25 mm dipped in paraffin oil of surface tension 0.0245 N/m rises to a height of 4 cm.
 (Angle of contact of paraffin with glass = 28° and acceleration due to gravity = 9.8 m/s^2 .)

OR

- A.** A wire of density ' ρ ' and Young's modulus ' Y ' is stretched between two rigid supports separated by a distance ' L ' under tension ' T '. Derive an expression for its frequency in fundamental mode. Hence show that $n = \frac{1}{2L} \sqrt{\frac{Yl}{\rho L}}$, where symbols have their usual meanings.
- B.** When the length of a simple pendulum is decreased by 20 cm, the period changes by 10%. Find the original length of the pendulum.
- Q.4. Select and write the most appropriate answer from the given alternatives for each sub-question:** [7]
- i. The bulging of earth at the equator and flattening at the poles is due to _____.
- (A) centripetal force (B) centrifugal force
 (C) gravitational force (D) electrostatic force
- ii. Young's modulus of material of wire is ' Y ' and strain energy per unit volume is ' E ', then the strain is
- (A) $\sqrt{\frac{Y}{2E}}$ (B) $\sqrt{\frac{E}{Y}}$
 (C) $\sqrt{\frac{2E}{Y}}$ (D) $\sqrt{2EY}$
- iii. The wavelength range of thermal radiation is
- (A) from 4000 \AA to 7000 \AA (B) from 7700 \AA to $4 \times 10^6 \text{ \AA}$
 (C) from 10^6 \AA to 10^8 \AA (D) from $4 \times 10^{-12} \text{ \AA}$ to $4 \times 10^8 \text{ \AA}$
- iv. A pipe open at both ends resonates to a frequency ' n_1 ' and a pipe closed at one end resonates to a frequency ' n_2 '. If they are joined to form a pipe closed at one end, then the fundamental frequency will be _____.
- (A) $\frac{n_1 n_2}{2n_2 + n_1}$ (B) $\frac{2n_2 n_1}{2n_2 + n_1}$
 (C) $\frac{2n_2 n_1}{n_1 + n_2}$ (D) $\frac{n_2 + 2n_1}{n_1 n_2}$
- v. The phase difference between displacement and acceleration of a particle performing S.H.M. is _____.
- (A) $\frac{\pi}{2}$ rad (B) π rad
 (C) 2π rad (D) $\frac{3\pi}{2}$ rad
- vi. Let n_1 and n_2 be the two slightly different frequencies of two sound waves. The time interval between waxing and immediate next waning is _____.
- (A) $\frac{1}{n_1 - n_2}$ (B) $\frac{2}{n_1 - n_2}$
 (C) $\frac{n_1 - n_2}{2}$ (D) $\frac{1}{2(n_1 - n_2)}$
- vii. A metal ball cools from 64°C to 50°C in 10 minutes and to 42°C in next 10 minutes. The ratio of rates of fall of temperature during the two intervals is _____.
- (A) $\frac{4}{7}$ (B) $\frac{7}{4}$
 (C) 2 (D) 2.5