1. Assume that a tunnel is dug along the diameter of the earth poles. A small body is dropped in to it so that the body performs simple harmonic motion. Neglect all the frictional forces and assume that earth has uniform density of ρ. The period of oscillation will be

(a) $\frac{2\pi}{\sqrt{\frac{4}{3}\pi G\rho}}$ (b) $\frac{2\pi}{\sqrt{\frac{4}{3}\pi\rho}}$ (c) $\frac{2\pi}{\sqrt{\frac{4}{3}\pi G}}$ (c) $\frac{2\pi}{\sqrt{G\rho}}$

2. A 1 g mass is suspended from a vertical spring. It executes simple harmonic motion with period 0.1 sec. By how much distance had the spring stretched when the mass was attached?

(a) 0.5 cm (b) 0.25 cm (c) 0.75 cm (d) 1.25 cm

3. A spherical soap bubble of radius 1.0 cm is formed inside another radius of 2.0 cm. The radius of single soap bubble which maintains the same pressure difference as inside the smaller and outside the large soap bubble is

(a) 6.67×10^{-5}m (b) 2.67×10^{-5}m (c) 2.67×10^{-3}m (d) 6.67×10^{-3}m

4. Twelve equal charges, q (same nature), are situated at the corners of a regular 12-sided planner polygon (for instance, one on each numeral of a clock face). The net force on a test charge Q at the center is (let r= be the distance between the charge 'q' to the test charge Q)

(a) Zero (b) $\frac{12qQ}{4\pi\varepsilon_0 r^2}$ (c) $\frac{6qQ}{4\pi\varepsilon_0 r^2}$ (d) $\frac{qQ}{4\pi\varepsilon_0 r^2}$

5. The potential at a point x (measured in μm) due to some charges situated on the x- axis is given by : $V(x) = \frac{20}{(x^2-4)}\ volt$. The electric field E at x= 4 μm is given by

(a) $\frac{5}{3}$ V/ μm and in the –ve x direction.

(b) $\frac{5}{3}$ V/ μm and in the +ve x direction

(c) $\frac{10}{9}$ V/ μm and in the –ve x direction

(d) $\frac{10}{9}$ V/ μm and in the +ve x direction

6. In an AC circuit, the voltage applied is $E = E_0 \sin\omega t$. The resulting current in the circuit is $I = I_0 \sin\left(\omega t - \frac{\pi}{2}\right)$. The power consumption in the circuit is given by

(a) $P = \frac{E_0 I_0}{\sqrt{2}}$ (b) P = 0 (c) $P = \frac{E_0 I_0}{2}$ (d) $\sqrt{2}\, E_0 I_0$

7. A charged particle of mass m and charge q travels on a circular path of radius r that is perpendicular to a magnetic field B. The time taken by the particle to complete one revolution is

(a) $2\pi mq/B$ (b) $2\pi q^2B/m$ (c) $2\pi qB/m$ (d) $2\pi m/qB$

8. An air cored solenoid has 300 turns, its length is 25 cm and its cross section is 3 cm^2. The self-inductance in Henry (given that $\mu=4\pi\times10^{-7}$).

(a) 5.1356×10^{-3} (b) 0.1356×10^{-5} (c) 0.1356×10^{-3} (d) 5.1356×10^{-5}

9. In electromagnetic wave the phase difference between electric and magnetic field vector **E** and **B** in a perfectly dielectric medium is

(a) 0 (b) $\pi/2$. (c) π (d) 2π.

10. A sphere of radius $\sqrt{7}$ cm at 727°C is suspended in a vacuum in an enclosure at 227°C. Find out the rate of loss of heat of the sphere assuming that it is a black body. Take $\sigma = 5.7\times10^{-8}\ W\ m^{-2}\ K^4$.

(a) 475 Watt (b) 470 Watt
(c) 465 Watt (d) 460 Watt

11. The *r.m.s* velocity of the molecule of a gas at 27°C is 1.82×10^3 m/s. What will be the *r.m.s.* velocity at 127°C?

(a) 2.1×10^4 m/s (b) 2.1×10^5 m/s.
(c) 22.1×10^3 m/s (d) 2.1×10^3 m/s

12. When an unpolarized light of intensity I_0 is incident on a polarizing sheet, the intensity of the light which does not get transmitted is

(a) $I_0/2$ (b) $I_0/4$ (c)zero (d) I_0

13. The wave function of a particle at a given time is

$$\psi(x) = \begin{cases} \sqrt{\frac{2}{L}}\sin\frac{\pi x}{L} & \text{for } 0 < x < L \\ 0 & \text{otherwise} \end{cases}$$

Find the probability of finding the particle in the range $\frac{L}{4} < x < \frac{3L}{4}$ at this time.

(a) 0.82 (b) 0.52 (c) 0.72 (d) 0.92

14. Calculate the longest wavelength that can be analyzed by a rock salt crystal of spacing $d = 2.82$ Å in the first order?

(a) 2.82 Å (b) 5.64 Å (c) 1.88 Å (d) 8.86 Å

15. In intrinsic semiconductor, the Fermi level lies

(a) Near conduction band
(b) Near valence band
(c) At midway of energy gap
(d) None of these

SOLUTION

1-A 2-B 3-D 4-A 5-D

6-B 7-D 8-C 9-A 10-B

11-D 12-A 13-A 14-B 15-C