

PHYSICS

1. At what temperature, the velocity of sound will be double its value at 273 K?
 - (1) $2 \times 273\text{K}$
 - (2) $4 \times 273\text{K}$
 - (3) $8 \times 273\text{K}$
 - (4) $16 \times 273\text{K}$
2. Two sound waves travel in the same direction in a medium. The amplitude of each wave is A and the phase difference between the two waves is 120° . The resultant amplitude will be
 - (1) A
 - (2) $2A$
 - (3) $4A$
 - (4) $\sqrt{2}A$
3. A tuning fork P of frequency 256 Hz produces 4 beats/s with another tuning fork Q . When a small amount of wax is attached to Q , the number of beats heard per second is 2. The original frequency of the fork Q is
 - (1) 258 Hz
 - (2) 262 Hz
 - (3) 260 Hz
 - (4) 256 Hz
4. An open organ pipe P_1 closed as one end vibrating in its first overtone and another pipe P_2 open at both ends vibrating in third overtone are in resonance with a given tuning fork. The ratio of the length of P_1 to that of P_2 is
 - (1) $8/3$
 - (2) $3/8$
 - (3) $1/2$
 - (4) $1/3$
5. What is the velocity of sound in water if bulk modulus of water is $2.0 \times 10^{10} \text{ dyne/cm}^2$
 - (1) $\sqrt{2} \times 10^5 \text{ cms}^{-1}$
 - (2) $\sqrt{2} \text{ ms}^{-1}$
 - (3) $1.4\sqrt{2} \times 300 \text{ ms}^{-1}$
 - (4) $\sqrt{2} \times 332 \text{ ms}^{-1}$
6. The equation of a stationary wave is :

$$y = 4 \sin\left(\frac{\pi x}{15}\right) \cos(96\pi t)$$
 The distance between a node and its next antinode is
 - (1) 7.5 units
 - (2) 1.5 units
 - (3) 22.5 units
 - (4) 30 units
7. A string is divided into three segments, so that the segments possess fundamental frequencies in the ratio 1 : 2 : 3. Then the lengths of the segments are in the ratio
 - (1) 6 : 3 : 2
 - (2) 4 : 3 : 2
 - (3) 4 : 2 : 1
 - (4) 3 : 2 : 1
8. If a stone is dropped into a lake from a tower, the sound of splash is heard by a man after 11.5 s, then what is the height of tower?
 - (1) 1000 m
 - (2) 100 m
 - (3) 500 m
 - (4) 150 m
9. The equation of a sound wave in air is $P = 0.01 \cos(1000t - 3x)$, where P , x and t are in S.I units. The bulk modulus of elasticity is $1.4 \times 10^5 \text{ Nm}^{-2}$. The displacement amplitude is
 - (1) 0.24 m
 - (2) $0.24 \times 10^{-7} \text{ m}$
 - (3) $8 \times 10^{-7} \text{ m}$
 - (4) 10 m
10. The velocity of sound is not affected by change in
 - (1) temperature
 - (2) medium
 - (3) pressure
 - (4) wavelength
11. A sound wave of pressure amplitude 14 pascal propagates through the air medium. The normal pressure of air is $1.0 \times 10^5 \text{ N/m}^2$. The difference between maximum and minimum pressure in the medium is
 - (1) $5 \times 10^5 \text{ N/m}^2$
 - (2) $10 \times 10^5 \text{ N/m}^2$
 - (3) 10 Nm^{-2}
 - (4) none
12. A longitudinal wave is represented by

$$x = x_0 \sin 2\pi \left(nt - \frac{x}{\lambda} \right)$$
 The maximum particle velocity will be four times the wave velocity if
 - (1) $\lambda = \frac{\pi x_0}{4}$
 - (2) $\lambda = 2\pi x_0$
 - (3) $\lambda = \frac{\pi x_0}{2}$
 - (4) $\lambda = 4\pi x_0$
13. A tuning fork of frequency 500Hz is sounded on a resonance tube. The first, second and third resonances are obtained at 17 cm, 52 cm and 87 cm respectively. The velocity of sound in ms^{-1}
 - (1) 170
 - (2) 350
 - (3) 520
 - (4) 850
14. A wire under tension vibrates with a frequency of 450 per second. What would be the fundamental frequency if the wire were half as long, twice as thick and under one fourth tension?
 - (1) 225 Hz
 - (2) 190 Hz
 - (3) 247 Hz
 - (4) 174 Hz
15. In the case of S.H.M. at the time of maximum kinetic energy.
 - (1) Potential energy must be zero
 - (2) Potential energy is minimum
 - (3) Potential energy must not be zero
 - (4) Potential energy is maximum

16. For a particle executing SHM, the potential energy is given by $U = U_0 \sin^2 \omega t$. The maximum K.E. is given by

- (1) U_0 (2) $\frac{U_0}{\sqrt{2}}$
 (3) $\frac{U_0}{\sqrt{3}}$ (4) none of these

17. In the case of S.H.M., if the particle is at the mean position then the particle is in

- (1) stable equilibrium (2) unstable equilibrium
 (3) neutral equilibrium (4) none

18. A particle of mass 10 kg is executing S.H.M. of time period 2 second and amplitude 0.25 m. The magnitude of maximum force on the particle is

- (1) 5N (2) 24.65 N
 (3) zero (4) 40.6 N

19. A particle of mass m is executing S.H.M. of time period T , and amplitude a_0 . The force on particle at the mean position is

- (1) $\frac{4\pi^2 m}{T^2} a_0$ (2) $\frac{2\pi^2 m}{T^2} a_0$
 (3) Zero (4) $\frac{\pi^2 m a_0}{T}$

20. The maximum acceleration in a SHM is α and the maximum velocity is β . The amplitude is

- (1) $\frac{\beta^2}{\alpha}$ (2) $\frac{\alpha}{\beta^2}$
 (3) $\alpha\beta$ (4) $\frac{\beta}{\alpha}$

21. A particle moves along y-axis according to equation $y = 3 + 4 \cos \omega t$. The motion of particle is

- (1) not SHM
 (2) oscillatory but not SHM
 (3) SHM
 (4) None

22. A flat horizontal board moves up and down in SHM of amplitude a . Then the shortest permissible time period of the vibration such that an object placed on the board may not lose contact with the board is

- (1) $2\pi \sqrt{\frac{g}{a}}$ (2) $2\pi \sqrt{\frac{a}{g}}$

- (3) $2\pi \sqrt{a \times g}$ (4) $\frac{1}{2\pi} \sqrt{\frac{g}{a}}$

23. The amplitude and the periodic time of a SHM are 5 cm and 6 sec respectively. At a distance of 2.5 cm away from the mean position, the phase will be

- (1) $\frac{\pi}{6}$ (2) $\frac{\pi}{4}$
 (3) $\frac{5\pi}{12}$ (4) $\frac{\pi}{3}$

24. A block rests on a horizontal table which is executing SHM in the horizontal plane with an amplitude 'a'. If the co-efficient of friction is μ , then the block just starts to slip when the frequency of oscillation is

- (1) $\frac{1}{2\pi} \sqrt{\frac{\mu g}{a}}$ (2) $\sqrt{\frac{\mu g}{a}}$
 (3) $2\pi \sqrt{\frac{a}{\mu g}}$ (4) $\sqrt{\frac{a}{\mu g}}$

25. A mass on the end of a spring undergoes simple harmonic motion with a frequency of 0.5 Hz of the attached mass is reduced to one quarter of its value, then the new frequency in Hz is

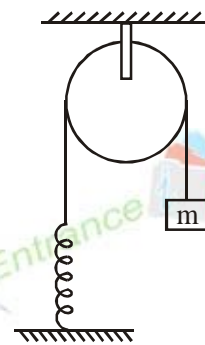
- (1) 4.5 (2) 2.0
 (3) 0.25 (4) 1.0

26. What is the phase difference between velocity and displacement in S.H.M?

- (1) 0 (2) $\frac{\pi}{2}$
 (3) $\frac{\pi}{4}$ (4) π

27. The string, the spring and the pulley shown in the fig. are light. The time period of the mass m is

- (1) $2\pi \sqrt{\frac{m}{k}}$
 (2) $\frac{1}{2\pi} \sqrt{\frac{m}{k}}$
 (3) $\frac{1}{2\pi} \sqrt{\frac{g}{k}}$
 (4) $2\pi \sqrt{\frac{m}{g}}$



28. The P.E. of a particle executing SHM is 2.5 J, when its displacement is half of amplitude. The total energy of the particle is
- (1) 2.5 J (2) 18 J
(3) 10 J (4) 12 J
29. The ratio of K.E. and P.E. possessed by a body executing SHM when it is at a distance of $\frac{1}{n}$ of its amplitude from the mean position is
- (1) n^2 (2) $\frac{1}{n^2}$
(3) $n^2 + 1$ (4) $n^2 - 1$
30. A particle is executing SHM with amplitude a and has maximum velocity v . Its speed at distance $\frac{a}{2}$ will be
- (1) $0.866 v$ (2) $\frac{v}{2}$
(3) v (4) $\frac{v}{4}$
31. A simple pendulum has a time period T . The pendulum is completely immersed in a non-viscous liquid whose density is $\frac{1}{20}$ th of that of the material of the bob. The time period of the pendulum immersed in the liquid is
- (1) T (2) $\frac{20}{19} T$
(3) $\sqrt{\frac{20}{19}} T$ (4) $\frac{19}{20} T$
32. A simple pendulum is suspended from the ceiling of a train. when the train moves with a constant acceleration 'a' the direction of the string from the vertical is
- (1) 0 (2) $\tan^{-1}\left(\frac{a}{g}\right)$
(3) $\sin^{-1}\left(\frac{a}{g}\right)$ (4) $\cos^{-1}\left(\frac{a}{g}\right)$
33. A pendulum bob has a speed of 3ms^{-1} at its lowest position. The pendulum is 0.5 m long. The speed of the bob, when the length makes an angle of 60° to the vertical, will be ($g = 10 \text{ms}^{-2}$)
- (1) $\frac{1}{2}\text{ms}^{-1}$ (2) 2ms^{-1}
(3) 12ms^{-1} (4) 3ms^{-1}
34. Two particles execute SHM of same amplitude and frequency along the same straight line. They pass one another when going in opposite directions, each time their displacement is half of their amplitude. The phase difference between them is
- (1) 90° (2) 30°
(3) 120° (4) 60°
35. A body is executing SHM when the displacement from the mean position is 4 cm and 5 cm, the values of the corresponding velocity of the body are 10m/s and 8 m/s then, the time period of the body is
- (1) $2\pi \text{ s}$ (2) $\frac{\pi}{2} \text{ s}$
(3) $\pi \text{ s}$ (4) $\frac{3\pi}{2} \text{ s}$
36. When two sound waves with a phase difference of $\frac{\pi}{2}$ and each having amplitude A and frequency ω , are superimposed on each other, then the maximum amplitude and frequency of resultant wave is
- (1) $\frac{A}{\sqrt{2}}, \frac{\omega}{2}$ (2) $\frac{A}{\sqrt{2}}, \omega$
(3) $\sqrt{2}A, \frac{\omega}{2}$ (4) $\sqrt{2}A, \omega$
37. Two waves are produced by two sources S_1 and S_2 . The phase difference between the two sources is always zero. The wavelength of two waves is equal to λ . At the point P, there will be destructive interference if $(S_1P - S_2P)$ path difference is equal to
- (1) 5λ (2) $\frac{3\lambda}{4}$
(3) 2λ (4) $\frac{11\lambda}{2}$
38. An open pipe is suddenly closed at one end with the result that the frequency of third harmonic of the closed pipe is found to be higher by 100 Hz than the fundamental frequency of the open pipe. The fundamental frequency of the open pipe is
- (1) 200 Hz (2) 300 Hz
(3) 240 Hz (4) 480 Hz
39. A wave travelling in positive X-direction with $A = 0.2$ m/sec. velocity = 360 m/sec. and $\lambda = 60\text{m}$, then correct expression for the wave is
- (1) $y = 0.2 \sin\left[2\pi\left(6t + \frac{x}{60}\right)\right]$

$$(2) y = 0.2 \sin \left[\pi \left(6t + \frac{x}{60} \right) \right]$$

$$(3) y = 0.2 \sin \left[2\pi \left(6t - \frac{x}{60} \right) \right]$$

$$(4) y = 0.2 \sin \left[\pi \left(6t - \frac{x}{60} \right) \right]$$

40. A person carrying a whistle emitting continuously a note of 272 Hz is running towards a reflecting surface with a speed of 18 km h^{-1} . The speed of sound in air is 345 ms^{-1} . The number of beats heard by him is

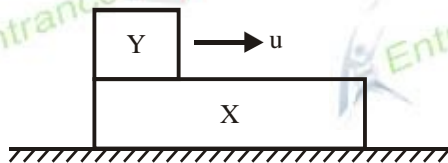
- (1) 4 (2) 6
(3) 8 (4) Zero

41. A small block of mass m is kept on a rough inclined surface of inclination θ fixed in an elevator. The elevator goes up with a uniform velocity v and the block does not slide on the wedge. The work done by the force of friction on the block in a time t will be

- (1) zero (2) $mgvt \cos^2 \theta$
(3) $mgvt \sin^2 \theta$ (4) $\frac{1}{2} mgvt \sin 2\theta$

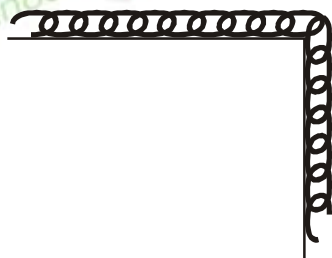
42. A block x of mass 2 m is at rest on a smooth horizontal surface. Another block y of mass m is placed on x at one end and it is projected along x -axis with a velocity u . The coefficient of friction between the blocks is ∞ . The final common velocity of the blocks will be

- (1) u
(2) $u/3$
(3) $u/2$
(4) $u/4$



43. A chain (uniform) of mass " M " and length l is hanging on a table such that $2/3$ of its total length lies over the table. If the coefficient of friction between the table and the chain is 0.5 . What is the work done by friction if the chain slips off completely

- (1) $\frac{Mgl}{9}$
(2) $-\frac{Mgl}{9}$
(3) $\frac{Mgl}{36}$
(4) $-\frac{Mgl}{36}$



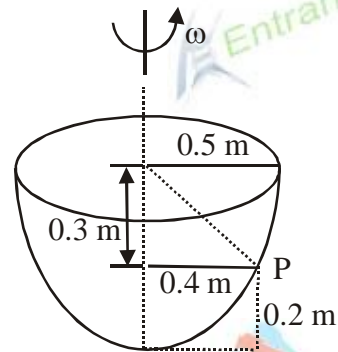
44. A block of mass M is pulled along a horizontal frictionless surface by a rope of mass m . If a force F is applied at one end of the rope, the force which the rope exerts on the block is

- (1) $F / (M + m)$ (2) F
(3) $FM / (m + M)$ (4) Zero

45. A lift is moving upwards with a uniform velocity v in which a block of mass m is lying. The frictional force offered by the block, when coefficient of friction is μ , will be

- (1) Zero (2) mg
(3) μmg (4) $2\mu mg$

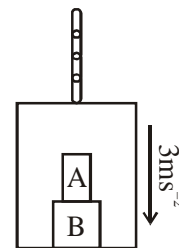
46. A particle P will be in equilibrium inside a hemispherical bowl of radius 0.5 m at a height 0.2 m from the bottom when the bowl is rotated at an angular speed ($g = 10 \text{ m/sec}^2$)



- (1) $10/\sqrt{3} \text{ rad/sec}$ (2) $10\sqrt{3} \text{ rad/sec}$
(3) 10 rad/sec (4) $\sqrt{20} \text{ rad/sec}$

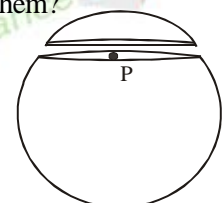
47. The elevator shown in figure is descending, with an acceleration of 3 ms^{-2} . The mass of the block $A = 1 \text{ kg}$. The force exerted by the block A on the block B is: [$g = 10 \text{ m/s}^2$]

- (1) 2N
(2) 7N
(3) 6N
(4) 8N



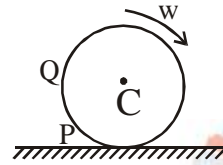
48. A spherical shell is cut into two pieces along a chord as shown in the figure. P is a point on the plane of the chord. The gravitational field at P due to the upper part is I_1 and that due to the lower part is I_2 . What is the relation between them?

- (1) $I_1 > I_2$
(2) $I_1 < I_2$
(3) $I_1 = I_2$
(4) No definite relation



49. The moment of inertia of a circular ring of radius R and mass M about a tangent in its plane is:

- (1) MR^2 (2) $\frac{3}{2}MR^2$
(3) $\frac{1}{4}MR^2$ (4) $\frac{5}{4}MR^2$



- (1) $V_Q > V_C > V_P$ (2) $V_Q < V_C < V_P$
(3) $V_Q = V_P, V_C = \frac{1}{2}V_P$ (4) $V_Q < V_C < V_P$

50. A disc is rolling (without slipping) on a frictionless surface. C is its centre and Q and P are two points equidistant from C . Let V_P, V_Q and V_C be the magnitudes of velocities of points P, Q and C respectively then: