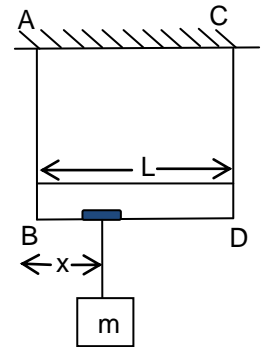


Single Correct Answer Type:

- The displacement due to a wave moving in the positive x-direction is given by $y = \frac{1}{(1+x^2)}$ at time $t = 0$ and by $y = \frac{1}{[1+(x-1)^2]}$ at $t = 2$ sec where x and y are in metres. The velocity of the wave in m/s is _____
 (A) 0.5 (B) 1 (C) 2 (D) 4
- A metal string is fixed between rigid supports. It is initially at negligible tension. Its young modulus is 'y', density is ' ρ ' and coefficient of thermal expansion is α . If it is now cooled through a temperature $= t$, transverse waves will move along it with speed _____
 (A) $y\sqrt{\frac{\alpha t}{\rho}}$ (B) $\alpha t\sqrt{\frac{y}{\rho}}$ (C) $\sqrt{\frac{y\alpha t}{\rho}}$ (D) $t\sqrt{\frac{y\alpha}{\rho}}$
- A string of length 0.4 m and mass 10^{-2} kg is clamped at its ends. The tension in the string is 1.6 N. When a pulse travels along the string, the shape of string is found to be the same at times t and $t + \Delta t$. The value of Δt is _____
 (A) 0.05 sec (B) 0.1 sec (C) 0.2 sec (D) 0.4 sec
- An open pipe is suddenly closed at one end as a result of which the frequency of the third harmonic of the closed pipe is found to be higher by 100 Hz than the fundamental frequency of the open pipe is _____
 (A) 200 Hz (B) 300 Hz (C) 240 Hz (D) 480 Hz
- Sound of wavelength ' λ ' passes through a Quincke's tube, which is adjusted to give a maximum intensity I_0 . Through what distance should be sliding tube be moved to give an intensity $\frac{I_0}{2}$.
 (A) $\frac{\lambda}{2}$ (B) $\frac{\lambda}{3}$ (C) $\frac{\lambda}{4}$ (D) $\frac{\lambda}{8}$
- A racing car moving towards a cliff sounds its horn. The driver observes that the sound reflected from the cliff has a pitch one octave higher than the actual sound of the horn. If $v =$ the velocity of sound, the velocity of the car is _____
 (A) $\frac{v}{\sqrt{2}}$ (B) $\frac{v}{2}$ (C) $\frac{v}{3}$ (D) $\frac{v}{4}$
- A wave is represented by the equation $y = A \sin 314 \left(\frac{t}{0.5 \text{ sec}} - \frac{x}{100 \text{ m}} \right)$ the frequency (n) and wavelength (λ) is _____
 (A) 100 Hz, 2m (B) 2 Hz, 100 m (C) 200 Hz, 4 m (D) 4 Hz, 200 m
- When a stretched string of length ' L ' is vibrating in a particular mode, the distance between two nodes on the string is ℓ . The sound produced in this mode of vibration constitutes the n^{th} overtone of the fundamental frequency of the string
 (A) $L = (n+1)\ell$ (B) $L = (n-1)\ell$ (C) $L = n\ell$ (D) $L = \left(n + \frac{1}{2}\right)\ell$

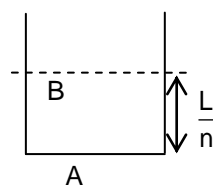
9. A heavy uniform rope hangs vertically from the ceiling with its lower end free. A disturbance on the rope travelling upward from the lower end has a velocity 'V' at a distance 'x' from the lower end
 (A) $V \propto \frac{1}{x}$ (B) $V \propto x$ (C) $V \propto \sqrt{x}$ (D) $V \propto \frac{1}{\sqrt{x}}$
10. In a mixture of gases, the average number of degrees of freedom per molecule is 6. The rms speed of the molecules of the gas is 'c'. The velocity of sound in the gas is _____
 (A) $\frac{c}{\sqrt{2}}$ (B) $\frac{3c}{4}$ (C) $\frac{2c}{3}$ (D) $\frac{c}{\sqrt{3}}$
11. Equations of a stationary and a travelling waves are as follows $y_1 = a \sin kx \cos \omega t$ and $y_2 = a \sin(\omega t - kx)$. The phase difference between two points $x_1 = \frac{\pi}{3k}$ and $x_2 = \frac{3\pi}{2k}$ are ϕ_1 and ϕ_2 respectively for the two waves. Then the ratio $\frac{\phi_1}{\phi_2}$ is _____
 (A) 1 (B) 5/6 (C) 3/4 (D) 6/7
12. When a source of sound of frequency 'f' crosses a stationary observer with a speed V_s (\ll speed of sound 'V'), the apparent change in frequency Δf is given by _____
 (A) $\frac{2fV_s}{V}$ (B) $2fV_s V$ (C) $\frac{2fV}{V_s}$ (D) $\frac{fV_s}{V}$
13. A closed organ pipe and an open organ pipe of same length produce 2 beats when they are set into vibrations simultaneously in their fundamental mode. The length of open organ pipe is now halved and of closed organ pipe is doubled, the number of beats produced will be
 (A) 8 (B) 7 (C) 4 (D) 2
14. Speed of sound wave is V. If a reflector moves towards a stationary source emitting waves of frequency f with speed 'u', the wave length of reflected wave will be _____
 (A) $\left(\frac{V-u}{V+u}\right)f$ (B) $\left(\frac{V+u}{V}\right)f$ (C) $\left(\frac{V+u}{V-u}\right)f$ (D) $\left(\frac{V-u}{V}\right)f$
15. The extension in a string obeying Hooke's law is 'x'. The speed of sound in the stretched string is V. If the extension in the string is increased to 1.5 x, the speed of sound will be
 (A) 1.22 V (B) 0.61 V (C) 1.50 V (D) 0.75 V
16. A travelling wave in a stretched string is described by the equation $y = A \sin(kx - \omega t)$. The maximum particle velocity is _____
 (A) Aw (B) ω/k (C) $\frac{d\omega}{dk}$ (D) $\frac{x}{t}$
17. A train moves towards a stationary observer with speed 34 ms^{-1} . The train sounds a whistle and its frequency registered by the observer is f_1 . If the train's speed is reduced to 17 ms^{-1} . The frequency registered is f_2 . If the speed of sound is 340 ms^{-1} then the ratio $\frac{f_1}{f_2}$ is _____
 (A) $\frac{18}{19}$ (B) $\frac{1}{2}$ (C) 2 (D) $\frac{19}{18}$
18. In a resonance tube with tuning fork of frequency 512 Hz. First resonance occurs at water level equal to 30.3 cm and second resonance occurs at 63.7 cm. The maximum possible error in the speed of sound is _____ (cm/sec)
 (A) 51.2 (B) 102.4 (C) 204.8 (D) 153.6

19. A transverse wave is described by the equation $y = y_0 \sin 2\pi \left(ft - \frac{x}{\lambda} \right)$. The maximum particle velocity is equal to four times the wave velocity if
- (A) $\lambda = \pi \frac{\lambda_0}{4}$ (B) $\lambda = \pi \frac{y_0}{2}$ (C) $\lambda = \pi y_0$ (D) $\lambda = 2\pi y_0$
20. A massless rod is suspended by two identical strings AB and CD of equal length. A block of mass 'm' is suspended from point 'O' such that BO is equal to 'x' farther, it is observed that the frequency of 1st harmonic (fundamental frequency) in AB is equal to 2nd harmonic frequency in CD. Then x is _____
- (A) $\frac{L}{5}$ (B) $\frac{4L}{5}$ (C) $\frac{3L}{4}$ (D) $\frac{L}{4}$



Numerical Based:

21. Two identical sounds A and B reach a point in the same phase. The resultant sound is 'C'. The loudness of 'C' is ndB higher than the loudness of A. The value of 'n' is _____
22. At a distance of 20 m from a point source, the loudness is 30 dB. After a minimum distance of $x(50\sqrt{10})$ metre the sound is inaudible. Value of 'x' is _____
23. A 4.0 kg block is suspended from the ceiling of an elevator through a string having a linear mass density of 19.2×10^{-3} kg/m. The speed (with respect to the string) with which a wave pulse can proceed on the string if the elevator accelerates up at the rate of 2.0 ms^{-2} is 12.5 m. What is the value of 'n' _____ ($g = 10 \text{ ms}^{-2}$)
24. A closed organ pipe is vibrating in fundamental frequency. There are two points A and B in the organ pipe as shown, at a distance $AB = \frac{L}{n}$. Ratio of maximum pressure variation at point A to point B is $\frac{2}{\sqrt{3}}$. Find value of 'n'.



25. Four harmonic waves of equal frequencies and equal intensities I_0 have phase angles $0, \frac{\pi}{3}, \frac{2\pi}{3}$ and π . When they are superposed, the intensity of the resulting wave is nI_0 . The value of 'n' is _____

KEY

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|-------|-------|-------|-------|-------|
| 1. A | 2. C | 3. B | 4. A | 5. D |
| 6. C | 7. A | 8. A | 9. C | 10. C |
| 11. D | 12. A | 13. B | 14. C | 15. A |
| 16. A | 17. D | 18. C | 19. B | 20. A |
| 21. 6 | 22. 4 | 23. 4 | 24. 3 | 25. 3 |