PHYSICS

BOOKS - DC PANDEY ENGLISH

WAVE MOTION

Example

1. In a wave motion $y = a\sin(kx - \omega t)$, y can represent.

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2. Show that the equation,$y = a\sin(\omega t - kx)$ satisfies the wave equation $\frac{\partial^2 y}{\partial t^2} = v^2 \frac{\partial^2 y}{\partial x^2}$. Find speed of wave and the direction in which it is travelling.

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3. A wave travelling along a string is described by, $y(x, t) = 0.005\sin(80.0x - 3.0t)$, in which the numerical constants are in SI units $\left(0.005m, 80.0\text{rad}m^{-1}, \text{ and } 3.0\text{rad}s^{-1}\right)$. Calculate (a) the amplitude, (b) the wavelength, and (c) the period and frequency of the wave. Also, calculate the displacement y of the wave at a distance x = 30.0 cm and time t = 20 s ?

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4. The equation of a wave is

$$y = (x, t) = 0.05\sin\left[\frac{\pi}{2}(10x - 40t) - \frac{\pi}{4}\right]m$$

find: (a) the wavelength, the frequency and the wave velocity

(b) the participle velocity and acceleration at $x = 0.5m$and $t = 0.05s$.

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5. Under what condition, maximum particle velocity is four times the wave velocity corresponding to the equation,

$y = A\sin(\omega t - kx)$

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6. A transverse sinusoidal wave moves along a string in the positive x-direction at a speed of $10cm/s$. The wavelength of the wave is 0.5 m and its amplitude is $10cm$. At a particular time t,the snapshot of the wave is shown in figure. The velocity of point P when its displacement is 5 cm is

(a) $\frac{\sqrt{3\pi}}{50}\hat{j}m/s$

(b) $-\frac{\sqrt{3\pi}}{50}\hat{j}m/s$

(c) $\frac{\sqrt{3\pi}}{50}\hat{i}m/s$

(d) $-\frac{\sqrt{3\pi}}{50}\hat{i}m/s$

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7. Equation of a transverse wave travelling in a rope is given by

$y = 5\sin(4.0t - 0.02x)$

where y and x are expressed in cm and time in seconds. Calculate

(a) the amplitude, frequency,velocity and wavelength of the wave.

(b) the maximum transverse speed and acceleration of a particle in the rope.

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8. Equation of a transverse wave travelling in a rope is given by

$y = 5\sin(4.0t - 0.02x)$

where y and x are expressed in cm and time in seconds, find phase difference $\Delta\Phi$.

(a) of same particle at two different times with interval of 1 s ,

(b) of two different particle located at a distance of 10cm at same time

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9. Speed of sound in air is $330m/s$.Find maximum and minimum wavelength of audible sound in air.

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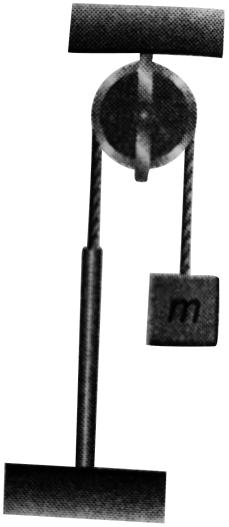
10. One end of $12.0m$ long rubber tube with a total mass of $0.9kg$ is fastened to a fixed support. A cord attached to the other end passes over a pulley and support an object with a mass of $5.0kg$. The tube is struck a transverse blow at one end. Find the time required for the pulse to reach the other end.$\left(g = 9.8m/s^2\right)$



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11. A wire of uniform cross-section is stretched between two points $100cm$ apart. The wire is fixed at one end and a weight is hung over a pulley at the other end. A weight of 9kg produces a fundamental frequency of $750Hz$.

(a) What is the velocity of the wave in wire?

(b) If the weight is reduced to $4kg$, what is the velocity of wave?

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12. A streched string is forced to transmit transverse waves by means of an oscillator coupled to one end. The string has a diameter of $4mm$. The amplititude of the oscillation is 10^{-4} m and the frequency is $10Hz$. Tension in the string is 100 N and mass density of wire is $4.2 \times 10^3 kg/m^3$. Find

(a) the equation of the waves along the string

(b) the energy per unit volume of the wave

(c) the average energy flow per unit time across any section of the string

and

(d) power required to drive the oscillator.

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Example Type 1

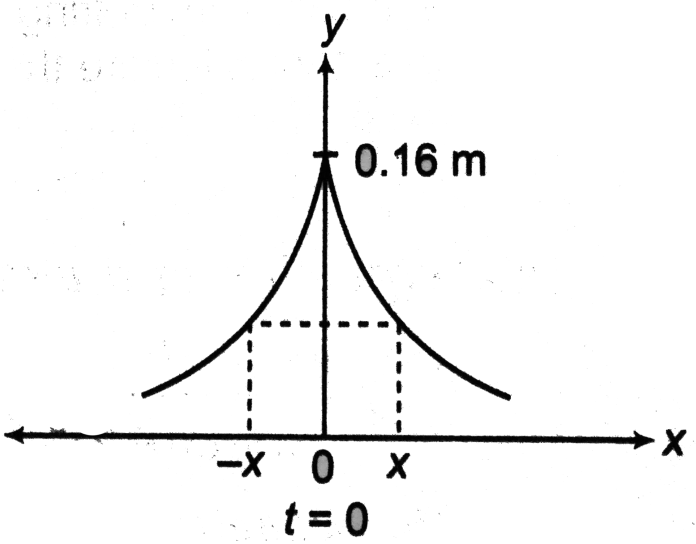
1. $y(x, t) = \dfrac{0.8}{\left[(4x + 5t)^2 + 5\right]}$ represents a moving pulse where x and y are in metre and t in second. Then,choose the correct alternative(s):

(a) pules is moving in positive x- direction

(b) in $2s$ it will travel a distance of $2.5m$

(c) its maximum displacement is $0.16m$

(d) it is a sysmmetric pulse



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Example Type 2

1. At time $t = 0, y(x)$ equation of a wave pulse is

$$y = \frac{10}{2 + (x-4)^2}$$

and at $t = 2s, y(x)$ equation of the same wave pulse is

$$y = \frac{10}{2 + (x+4)^2}$$

Here, y is in mm and x in metres. Find the wave velocity.

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Example Type 3

1. A wave is travelling along positive x- direction with velocity $2m/s$.

Further, $y(x)$ equation of the wave pulse at $t = 0$ is

$$y = \frac{10}{2 + (2x + 4)^2}$$

(a) From the given information make complete $y(x, t)$ equation.

(b) Find $y(x)$ equation at $t = 1s$

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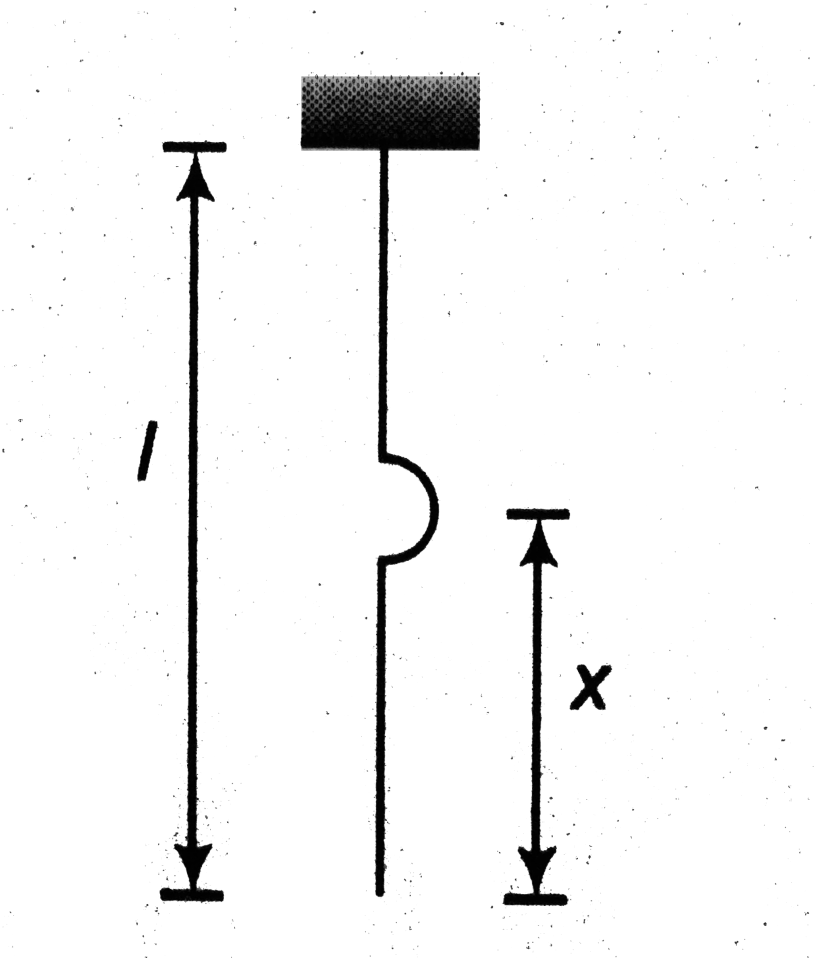
Example Type 4

1. A uniform rope of mass $0.1kg$ and length $2.45m$ hangs from a ceiling.

(a) Find the speed of transverse wave in the rope at a point $0.5m$ distant from the lower end.

(b) Calculate the time taken by a transverse wave to travel the full length

of the rope.



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Type 5

1. Figure shows a snapshot of a sinusoidal travelling wave taken at $t = 0.3s$.The wavelength is $7.5cm$ and the amplitude is $2cm$. If the crest P was at $x = 0$at $t = 0$, write the equation of travelling wave. ,

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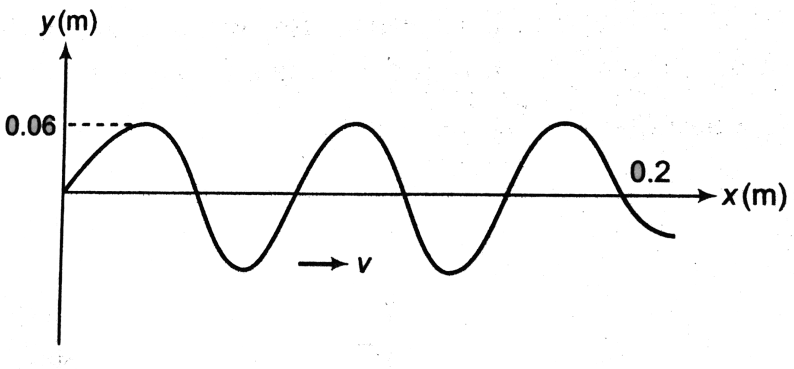
Example Type 5

1. For the wave shown in figure, write the equation of this wave if its position is shown at $t = 0$. Speed of wave is $v = 300m/s$.



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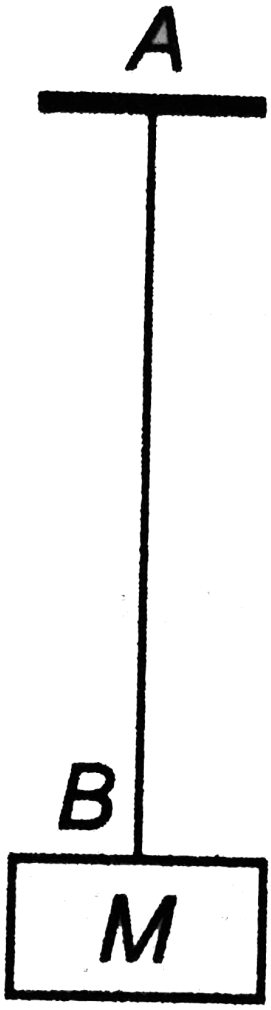
Miscellaneous Examples

1. A block of mass $M = 2kg$ is suspended from a string AB of mass $6kg$ as shown in figure. A transverse wave pulse of wavelength λ_0 is produced at point B. find its wavelength while reaching at point A.



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2. A wave moves with speed $300m/s$ on a wire which is under a tension of $500N$. Find how much tension must be changed to increase the speed to $312m/s$?

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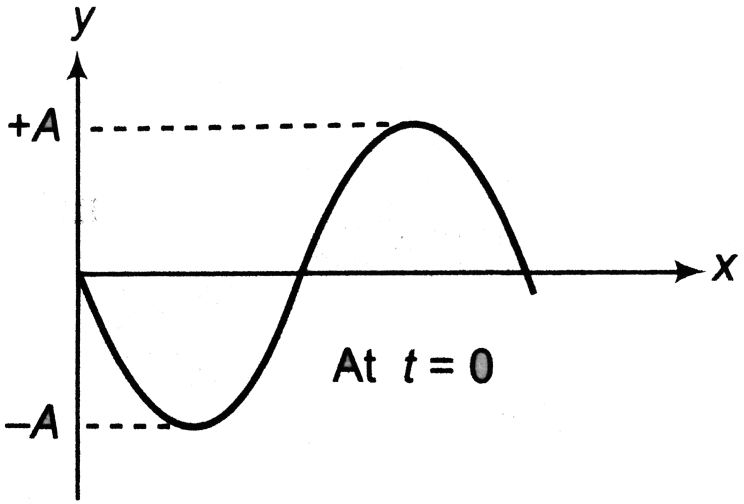
3. For a wave described by $y = A\sin(\omega t - kx)$, consider the following or not and in what direction and describe whether the particle is speeding up, slowing sown or instantanteously not accelerating?



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4. A thin string is held at one end and oscillates so that,

$y(x = 0, t) = 8 \sin 4t(cm)$

Neglect the gravitattional force. The dtring's linear mass density is $0.2kg/m$ and its tension is $1N$. The string passes through a bath filled with $1kg$ water. Due to friction heat is transferred to the bath. The heat transfer efficiency is $50\,\%$. Calculate how much time passes before the temperature of the bath rises one degree kelvin?

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5. Consider a wave propagating in the negative x-direction whose frequency is $100Hz$. At $t = 5s$,the displacement associated with the wave is given by

$y = 0.5 \cos(0.1x)$

where x and y are measured in centimetres and t in seconds. Obtain the

displacement (as a function of x) at $t = 10s$. What is the wavelength and velocity associated with the wave?

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6. A simple harmonic wave of amplitude 8 units travels along positive x-axis. At any given instant of time, for a particle at a distance of $10cm$ from the origin, the displacement is $+6units$, and for a particle at a distance of $25cm$ from the origin, the displacement is $+4$ units. Calculate the wavelength.

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7. A wave pulse on a horizontal string is represented by the function

$$y(x, t) = \frac{5.0}{1.0 + (x - 2t)^2} \text{ (CGS units)}$$

plot this function at $t = 0, 2.5$ and $5.0s$.

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8. A uniform circular hoop of string is rotating clockwise in the absence of gravity. The tangential speed is v_0. Find the speed of the wave travelling on this string.

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9. A sinusoidal wave trsvelling in the positive direction on a stretched string has amplitude $2.0cm$, wavelength $1.0m$ and velocity $5.0m/s$. At $x = 0$ and $t = 0$ it is given that $y = 0$ and $\frac{\partial y}{\partial t} < 0$. Find the wave function $y(x, t)$.

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Exercise 17.1

1. Prove that the equation $y = a \sin \omega t$ does not satisfy the wave equation and hence it does not represent a wave.

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2. A wave pulse is described by $y(x,t) = ae^{-(bx-ct)}$ ^ (2), where a,b,and c are positive constants. What is speed of this wave?

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3. you have learnt that a travelling wave in one dimension is represented by a function $y = f(x,t)$ where x and t must appear in the combination $ax \pm bt$ or $x - vt$ or $x + vt$,i.e. $y = f(x \pm vt)$. Is the converse true? Examine if the folliwing function for y can possibly represent a travelling wave

(a) $(x - vt)^2$

(b) $\log[(x + vt)/x_0]$

(c) $1/(x + vt)$

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4. The equation of a wave travelling on a string stretched along the X-axis is given by

$y = Ae^{\left(\frac{-x}{a}+\frac{t}{T}\right)^2}$

(a) Write the dimensions of A, a and T.

(b) Find the wave speed.

(c) In which direction is the wave travelling?

(d) Where is the maximum of the pulse located at $t = T$ and at $t = 2T$?

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Exercise 17.2

1. Consider the wave $y = (5mm)\sin\left[1cm^{-1}x - \left(60s^{-1}\right)t\right]$. Find (a) the amplitude, (b) the angular wave number, (c) the wavelength, (d) the frequency, (e) the time period and (f) the wave velocity.

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2. A wave is described by the equation $y = (1.0mm)\sin\pi\left(\frac{x}{2.0cm} - \frac{t}{0.01s}\right)$.

(a) Find time period and wavelength.

(b) Find the speed of particle at $x = 1.0cm$ and time $t = 0.01s$.

(c) What are the speed of the partcle at $x = 3.0cm, 5.0cm$ and $7.0cm$ at $t = 0.01s$?

(d) What are the speeds of the partcle at $x = 1.0cm$ at $t = 0.011$, 0.012 and $0.013s$?

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Exercise 17.3

1. The equation of a wave travelling on a string is $y = (0.10mm)\sin\left[\left(31.4m^{-1}\right)x + \left(314s^{-1}\right)t\right]$

(a) In which direction does the travel?

(b) Find the wave speed, the wavelength and the frequency of the wave.

(c) What is the maximum displacement and the maximum speed of a portion of the string?

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2. The equation for a wave travelling in x-direction On a string is

$y = (3.0cm)\sin\left[(3.14cm^{-1}x - (314s^{-1}t\right]$

(a) Find the maximum velocity of a particle of the string.

(b) Find the acceleration of a particle at $x = 6.0cm$ at time $t = 0.11s$

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3. The equation of a travelling wave is

$$y(x, t) = 0.02\sin\left(\frac{x}{0.05} + \frac{t}{0.01}\right)m$$

Find (a) the wave velocity and

(b) the particle velocity at $x = 0.2m$ and $t = 0.3s$.

Given $\cos\theta = -0.85$, where $\theta = 34rad$

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4. A wave of frequency $500Hz$ has a wave velocity of $350m/s$.

(a) Find the distance between two points which are $60\circ$ out of phase.

(b) Find the phase difference between two displacement at a certain point at time $10^{-3}s$ apart.

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Exercise 17.4

1. Speed of light in vacuum is $3 \times 10^8 m/s$. Range of wavelength of visible light is $4000\text{Å} - 7000\text{Å}$. Find the range of frequency of visible light.

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2. Speed of sound in air is $330m/s$. Frequancy of Anoop's voice is $1000Hz$ and of Shibham's voice is $2000Hz$. Find the wavelength corresponding to their voice.

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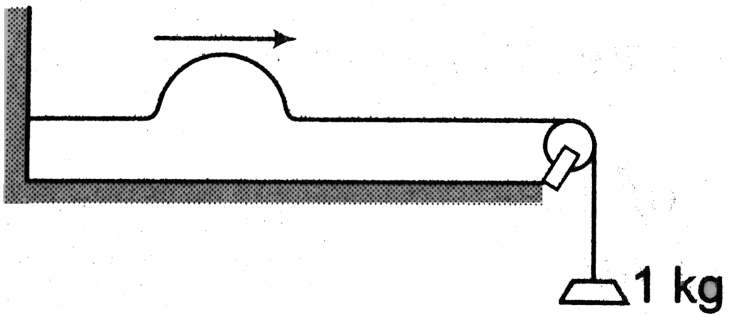
Exercise 17.5

1. Figure shows a string of linear mass density $1.0 g cm^{-1}$ on which a wave pulse is travelling. Find the time taken by pulse in travelling through a distance of $50 cm$ on the string. Take $g = 10 m s^{-2}$



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2. A steel wire of length $64 cm$ weighs $5 g$. If it is stretched by a force of 8N` what would be the speed of transverse wave passing on it?

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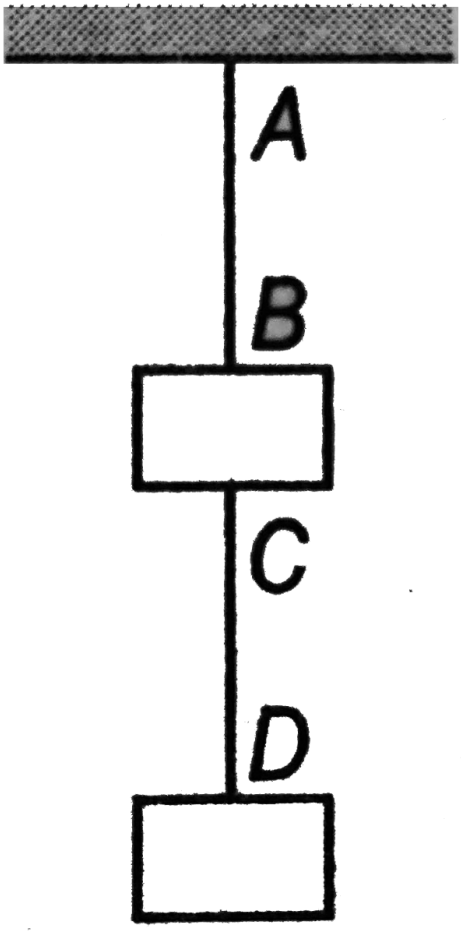
3. Two blocks each having a mass of $3.2kg$ are connected by a wire CD and system is suspended from the ceiling by another wire AB. The linear mass density of the wire AB is $10gm^{-1}$ and $t\hat{o}f$CDis8 gm^(-1)`. Find the speed

of a transverse wave pulse produced in AB and in CD.



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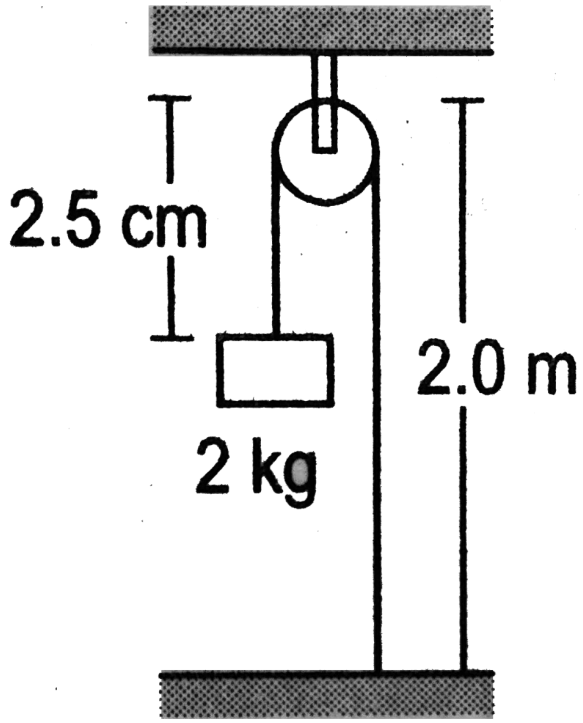
4. In the arrengement shown in figure, the string has a mass of $4.5g$. How much time will it take for a transverse disturbance produced at the floor to reach the pulley? Take $g = 10ms^{-2}$.



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5. A copper wire $2.4mm$ in diameter is $3m$ long and is used to suspend a $2kg$ mass from a beam. If a trasverse disturbance is sent along the wire by striking it lightly with a pencil, how fast will the disturbance travel? The density of copper is $8920kg/m^3$.

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6. One end of a horizontal rope is attached to a prong of an electrically driven fork that vibrates at $120Hz$. The other end passes over a pulley and supports a $1.50kg$ mass. The linear mass density of the rope is $0.0550kg/m$.

(a) What is the speed of a transverse wave on the rope?

(b) Whatis the wavelength?

How would your answer to parts (a) and (b) change if the mass were increased to $3.00kg$?

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Exercise 17.6

1. Spherical waves are emitted from a $1.0W$ source in an isotropic non-absorbing medium. What is the wave intesity $1.0m$ from the source?

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2. A line source emits a cylindrical expanding wave. Assuming the medium absorbs no energy find how the ampitude and intensity of wave depend on the distance from the source?

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3. A certain $120Hz$ wave on a string has an amplitude of $0.160mm$. How much energy exits in an$80g$ length of the string?

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4. A taut string for which $\mu = 5.00 \times 10^{-2} kg/m$ under a tension of $80.0N$. How much power must be supplied to the string to generate sinusoidal waves at a frequency of $60.0Hz$ and an amplitude of $6.00cm$?

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5. A $200Hz$ wave with amplitude $1mm$ travels on a long string of linear mass density $6g/m$ keep under a tension of $60N$.

(a) Find the average power transmitted across a given point on the string.

(b) Find the total energy associated with the wave in a $2.0m$ long portion of the string.

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6. A trasverse wave of amplitude $0.50mm$ and frequency $100Hz$ is produced on a wire stretched to a tension of $100N$. If the wave speed is $100m/s$. What average power is the source transmitting to the wire?

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Level 1 Assertion And Reason

1. Assertion: Mechanical transverse waves can't travel in gaseous medium.

Reason : They do no possess modulus of rigidity.

A. If both Assertion and Reason are true and the Reason is correct expanation of the Assertion.

B. If both Assertion and Reason are true but the Reason is not correct expanation of the Assertion.

C. If Assertion is true, but the Reason is false.

D. If Assertion is false but the Reason is true.

Answer: D

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2. Assertion: Surface waves are neither transverse nor longitudinal.

Reason: In surface wave particles undergo circular motion.

A. If both Assertion and Reason are true and the Reason is correct expanation of the Assertion.

B. If both Assertion and Reason are true but the Reason is not correct expanation of the Assertion.

C. If Assertion is true, but the Reason is false.

D. If Assertion is false but the Reason is true.

Answer: B

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3. Assertion: Two equations of wave are $y_1 = A\sin(\omega t - kx)$ and $y_2 A\sin(kx - \omega t)$. These two waves have a phase difference of π.

Reason: They are travelling in opposite directions.

A. If both Assertion and Reason are true and the Reason is correct expanation of the Assertion.

B. If both Assertion and Reason are true but the Reason is not correct expanation of the Assertion.

C. If Assertion is true, but the Reason is false.

D. If Assertion is false but the Reason is true.

Answer: C

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4. Assertion: Wave speeds is given by $v = f\lambda$. If frequency f is doubled, v will becomes two times.

Reason : For given conditions of medium wave speed remains constant.

A. If both Assertion and Reason are true and the Reason is correct expanation of the Assertion.

B. If both Assertion and Reason are true but the Reason is not correct expanation of the Assertion.

C. If Assertion is true, but the Reason is false.

D. If Assertion is false but the Reason is true.

Answer: D

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5. Assertion : On moon you cannot hear your friend standing at some distance from you.

Reason : There is a vacuum on moon.

A. If both Assertion and Reason are true and the Reason is correct expanation of the Assertion.

B. If both Assertion and Reason are true but the Reason is not correct expanation of the Assertion.

C. If Assertion is true, but the Reason is false.

D. If Assertion is false but the Reason is true.

Answer: A

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6. Assertion : Wave number is the number of waves per units length.

Reason : Wave number $= \frac{1}{\lambda}$.

A. If both Assertion and Reason are true and the Reason is correct expanation of the Assertion.

B. If both Assertion and Reason are true but the Reason is not correct expanation of the Assertion.

C. If Assertion is true, but the Reason is false.

D. If Assertion is false but the Reason is true.

Answer: A

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7. Assertion : Electromagnetic waves do not require medium for their propagation.

Reason : They can't travel in a medium.

A. If both Assertion and Reason are true and the Reason is correct expanation of the Assertion.

B. If both Assertion and Reason are true but the Reason is not correct expanation of the Assertion.

C. If Assertion is true, but the Reason is false.

D. If Assertion is false but the Reason is true.

Answer: C

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8. Assertion : Two strins shown in figure have the same tension. Speed of transverse waves in string -1 will be more.

Reason :

$v \propto \frac{1}{\sqrt{\mu}}$,Here`mu is mass per unit length of string.

A. If both Assertion and Reason are true and the Reason is correct expanation of the Assertion.

B. If both Assertion and Reason are true but the Reason is not correct expanation of the Assertion.

C. If Assertion is true, but the Reason is false.

D. If Assertion is false but the Reason is true.

Answer: D

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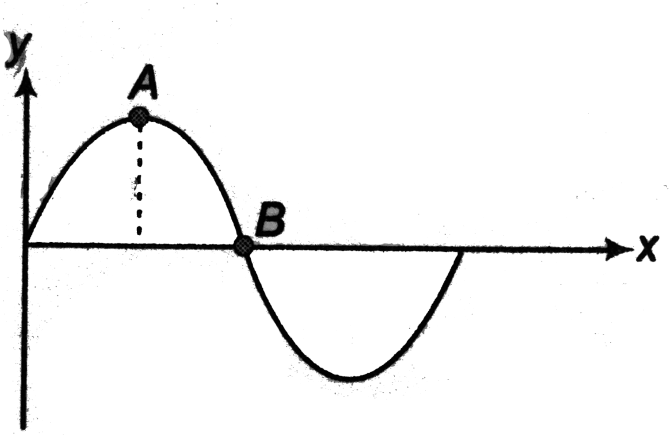
9. Assertion: $y - x$ graph of a transverse wave on a string is as shown in figure. At point A potential energy and kinetic energy both are minimum.

Reason : At point B kinetic energy and potential energy both are



maximum.

A. Both Assertion and Reason are true and the Reason is correct expanation of the Assertion.

B. Both Assertion and Reason are true but the Reason is not correct expanation of the Assertion.

C. Assertion is true, but the Reason is false.

D. Assertion is false but the Reason is true.

Answer: B

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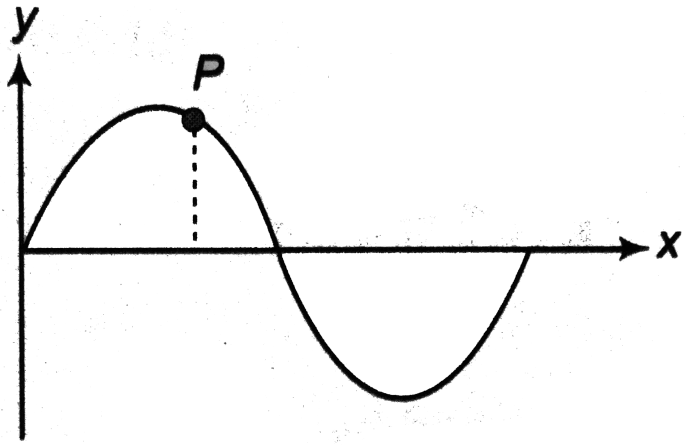
10. Assertion : $y - x$ graph of a transverse wave on a string is as shown in figure. At the given instant point P is moving downwards. Hence, we can say that wave is moving towards positive `x-direction.



Reason : Particle velocity is given by

$$vp = -v\frac{\partial y}{\partial x}$$

A. If both Assertion and Reason are true and the Reason is correct expanation of the Assertion.

B. If both Assertion and Reason are true but the Reason is not correct expanation of the Assertion.

C. If Assertion is true, but the Reason is false.

D. If Assertion is false but the Reason is true.

Answer: D

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Objective Questions

1. Equations of progressive wave is given by

$y = 4\sin\left[\pi\left(\frac{t}{5} - \frac{x}{9}\right) + \frac{\pi}{6}\right]$ Then , which of the following is correct ?

A. $v = 5m/s$

B. $\lambda = 18m$

C. $A = 0.04m$

D. $f = 50Hz$

Answer: B

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Level 1 Objective

1. The equation of a wave is given by $Y = 5\sin 10\pi(t - 0.01x)$ along the x-axis. (All the quantities are expressed in SI units). The phase difference between the points separated by a distance of $10m$ along x-axis is

A. $\frac{\pi}{2}$

B. π

C. 2π

D. $\frac{\pi}{4}$

Answer: B

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2. The displacement function of a wave travelling along positive x-direction is $y = \frac{1}{2 + 3x^2}$ at t=0 and by y = (1)/(2) + 3(x - 2)^(2)) at t = 2 s

, $where$y and x` are in metre. The velocity of the wave is

A. (a) $2m/s$

B. (b) $0.5m/s$

C. (c) $1m/s$

D. (d) $3m/s$

Answer: C

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3. The angle between wave velocity and particle velocity in a travelling wave be

A. zero

B. $\frac{\pi}{2}$

C. π

D. All of these

Answer: D

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4. A source oscillates with a frequency $25Hz$ and the wave propagates with $300m/s$. Two points A and B are located at distances $10m$ and $16m$ away from the source. The phase difference between A and B is

A. $\frac{\pi}{4}$

B. $\frac{\pi}{2}$

C. π

D. 2π

Answer: C

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5. The equation of a transverse wave propagating in a string is given by

$y = 0.02\sin(x + 30t)$

where, x and y are in second.

If linear density of the string is $1.3 \times 10^{-4} kg/m$, then the tension in the string is

A. $0.12N$

B. $1.2N$

C. $12N$

D. $120N$

Answer: A

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6. A harmonic oscillator vibrates with amplitude of $4cm$ and performs 150 oscillations in minute. If intial phase is 45° and it starts moving away from the origin, then the equation of motion is

A. $0.04 \sin\left(\left(5\pi t + \frac{\pi}{4}\right)\right.$

B. $0.04 \sin\left(\left(5\pi t - \frac{\pi}{4}\right)\right.$

C. $0.04 \sin\left(\left(4\pi t + \frac{\pi}{4}\right)\right.$

D. $0.04 \sin\left(\left(4\pi t - \frac{\pi}{4}\right)\right.$

Answer: A

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Level 1 Subjective

1. A certain transverse wave is described by

$$y(x, t) = (6.50mm)\cos 2\pi\left(\frac{x}{28.0cm} - \frac{t}{0.0360s}\right).$$

Determine the wave's

(a) amplitude , (b) wavelength

(c) frequency , (d) speed of propagation and

(e) direction of propagation.

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2. For the wave $y = 5\sin 30\pi[t - (x/240)]$, where x and y are in cm and t is in seconds, find the

(a) displacement when $t = 0$ and $x = 2cm$

(b) wavelength

(c) velocity of the wave and

(d) frequency of the wave

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3. The displacement of a wave disturbance propagating in the positive x-direction is given by

$y = \frac{1}{1+x^2}$ at $t = 0$ and $y = \frac{1}{1+(x-1)^2}$ at $t = 2s$

where, x and y are in meter. The shape of the wave disturbance does not change during the propagation. what is the velocity of the wave?

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4. A travelling wave pulse is given by $y = \frac{10}{5 + (x + 2t)^2}$

Here, x and y are in meter and t in second. In which direction and with what velocity is the pulse propagation. What is the ampitude of pulse?

Watch Video Solution

5. Is their any relationship between wave speed and the maximum partcle speed for a wave travelling on a string? If so, what is it?

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6. Calculate the velocity of a transverse wave along a string of length $2m$ and mass $0.06kg$ under a tension of $500N$.

Watch Video Solution

7. Calculate the speed of a transverse wave in a wire of $1.0mm^2$ cross-section under a tension of $0.98N$. Density of the material of wire is

$9.8 \times 10^3 kg/m^3$

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8. If at $t = 0$, a travelling wave pulse in a string is described by the function,

$$y = \frac{10}{(x^2 + 2)}$$

Hence, x and y are in meter and t in second. What will be the wave function representing the pulse at time t, if the pulse is propagating along positive x-axix with speed $2m/s$?

Watch Video Solution

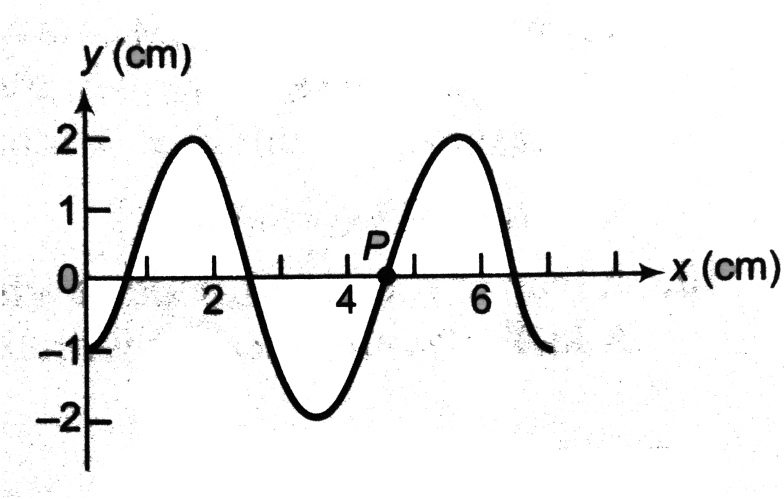
9. Consider a sinusoidal travelling wave shown in figure. The wave velocity is $+40cm/s$.

Find

(a) the frequency

(b) the phase difference between points $2.5cm$ apart

(c) the velocity of a particle at P at the instant shown.



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10. The equation of a travelling wave is

$$y(x,t) = 0.02\sin\left(\frac{x}{0.05} + \frac{t}{0.01}\right)m$$

Find (a) the wave velocity and

(b) the particle velocity at $x = 0.2m$ and $t = 0.3s$.

Watch Video Solution

11. Transverse waves on a srting have speed $12.0m/s$, amplitude $0.05m$ and wavelength $0.4m$. The waves travel in the $+x-direction$ and at $t=0$ the $x=0$ end of the string has zero displacement and is moving upwards.

(a) Write a wave function describing the wave.

(b) Find the transverse displacement of a point at $x=0.25m$ at time $t=0.15s$.

(c) How much time must elapse from the instant in part (b) until the point at $x=0.25m$ has zero dispacement?

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12. A wave is described by the equation $y=(1.0mm)\sin\pi\left(\frac{x}{2.0cm}-\frac{t}{0.01s}\right)$.

(a) Find time period and wavelength.

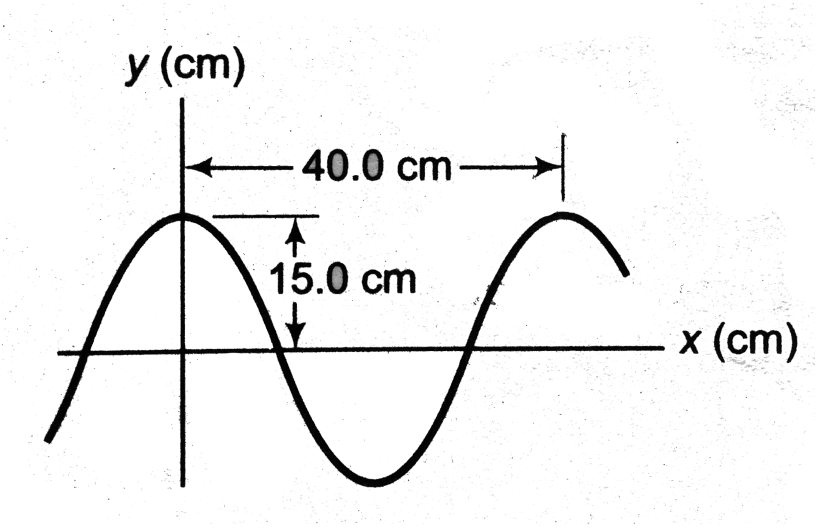
(b) Find the speed of particle at $x=1.0cm$ and time $t=0.01s$.

(c) What are the speed of the partcle at $x=3.0cm, 5.0cm$ and $7.0cm$ at $t=0.01s$?

(d) What are the speeds of the partcle at $x = 1.0cm$ at $t = 0.011$, 0.012 and $0.013s$?

Watch Video Solution

13. A sinusoidal wave travelling in the positive x-direction has an amplitude of $15.0cm$, a wavelength of $40.0cm$ and a frequency of $8.00Hz. The vertic \leq displacement of the medium at$ t = 0 and x = 0 $is also$ 15.0 cm` as shown in figure.



(a) Find the angular wave number k, period T, angular frequency ω and speed v of the wave.

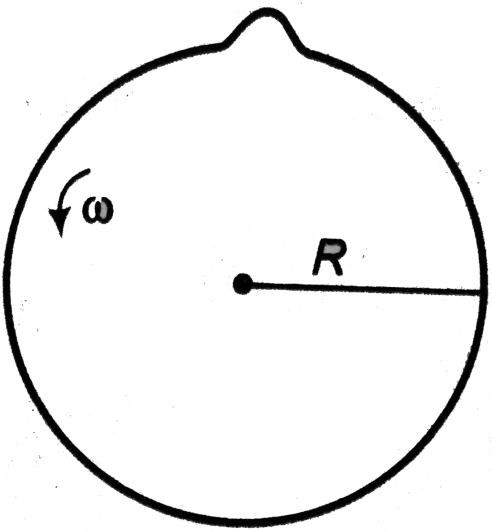
(b) Write a general expression for wave function.

Watch Video Solution

14. A flexible steel cable of total length L and mass per unit length μ hangs vertically from a support at one end. (a) Show that the speed of a transverse wave down the cable is $v = \sqrt{g(L - x)}$, where x is measured from the support. (b) How long will it takes for a wave to travel down the cable?

Watch Video Solution

15. A loop of rope is whirled at a high angular velocityω, so that it becomes a taut circle of radius$R$. A kink develops in the whirling rope.



(a) Show that the speed of the kink in the rope is $v = \omega R$.

(b) Under what conditions does the kink remains stationary relative to an observer on the ground?

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16. A non-uniform wire of length l and mass M has a variable linear mass density given by $\mu = kx$, where x is distance from one end of wire and k is a constant. Find the time taken by a pulse starting at one end to reach the other end when the tension in the wire is T.

Watch Video Solution

17. The speed of propagation of a wave in a medium is $300m/s$. The equation of motion of point at $x = 0$ is given by $y = 0.04 \sin 600\pi t(metre)$. The displacement of a point $x = 75cm$ at $t = 0.01s$ is

Watch Video Solution

Level 2 Single Correct

1. A $100Hz$ sinusoidal wave is travelling in the posotive x-direction along a string with a linear mass density of $3.5 \times 10^{-3} kg/m$ and a tension of $35N$. At time $t = 0$, the point $x = 0$, has maximum displacement in the positive y-direction. Next when this point has zero displacement, the slope of the string is $\pi/20$. Which of the following expression represent (s) the displacement of string as a function of x(in metre) and t (in second)

A. $y = 0.025\cos(200\pi t - 2\pi x)$

B. $y = 0.5\cos(200\pi t - 2\pi x)$

C. $y = 0.025\cos(100\pi t - 10\pi x)$

D. $y = 0.5\cos(100\pi t - 10\pi x)$

Answer: A

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2. Vibrations of period $0.25s$ propagate along a straight line at a velocity of $48cm/s$. One second after the the emergence of vibrations at the intial point, displacement of the point, $47cm$ from it is found to be $3cm$. [Assume that at intial point particle is in its mean position at $t = 0$ and moving upwards]. Then,

A. amplitude of vibrations is $6cm$

B. amplitude of vibrations is $3\sqrt{2}cm$

C. amplitude of vibrations is $3cm$

D. None of these

Answer: A

Watch Video Solution

3. Transverse waves are generated in two uniform steel wires A and B by attaching their free ends to a fork of frequency $500Hz$. The diameter of wire A is half that B and tension in wire A is half the tension in wire B. What is the ratio of velocities of waves in A and B?

A. $1:2$

B. $\sqrt{2}:1$

C. $2:1$

D. $1:\sqrt{2}$

Answer: B

Watch Video Solution

4. The frequency of A note is 4 times that of B note. The energies of two notes are equal. The amplitude of b notes as compared to that of A note will be

A. double

B. equal

C. four times

D. eight times

Answer: C

Watch Video Solution

5. If at $t = 0$, a travelling wave pulse on a string is described by the function.

$$y = \frac{6}{x^2 + 3}$$

What will be the waves function representing the pulse at time t, if the pulse is propagating along positive x-axis with speed $4m / s$?

A. $y = \frac{6}{(x+4t)^2} + 3$

B. $y = \frac{6}{(x-4t)^2} + 3$

C. $y = \frac{6}{(x-t)^2}$

D. $y = \frac{6}{(x-t)^2} + 12$

Answer: B

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Level 2 More Than One Correct

1. A transverse wave travelling on a stretched string is is represented by the equation

$y = \frac{2}{(2x-6.2t)^2} + 20$. Then ,

A. (a)velocity of the wave is $3.1m/s$

B. (b) amplitude of the wave is $0.1m$

C. (c)frequency of the wave is $20Hz$

D. (d) wavelength of the wave is $1m$

Answer: A::B

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2. For energy density, power and intensity of any wave choose the correct options.

A. $u = \text{energy density} = \frac{1}{2}\rho\omega^2 A^2$

B. $P = \text{power} = \frac{1}{2}\rho\omega^2 A^2 Sv$

C. $I = \text{intensity} = \frac{1}{2}\rho\omega^2 A^2 Sv$

D. $I = \frac{P}{S}$

Answer: A::D

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3. For the transverse wave equation $y = A\sin(\pi x + \pi t)$, choose the correct option at $t = 0$

A. points at $x = 0$ and $x = 1$ are at mean positions

B. points at $x = 0.5$ and $x = 1.5$ have maximum accelerations

C. points at $x = 0.5$ and $x = 1.5$ are at rest

D. the given wave is travelling in negative x-direction

Answer: A::B::C::D

Watch Video Solution

4. In the wave equation,

$$y = A\frac{\sin(2\pi)}{a}(x - bt)$$

A. speed of wave is a

B. speed of wave is b

C. wavelength of wave is a/b

D. wavelength of wave is a

Answer: B::D

Watch Video Solution

5. In the wave equation,

$$y = A\sin(2\pi)\left(\frac{x}{a} - \frac{t}{b}\right)$$

A. speed of wave is a/b

B. speed of wave is b/a

C. wavelength of wave is a

D. Time period of wave is b

Answer: A::C::D

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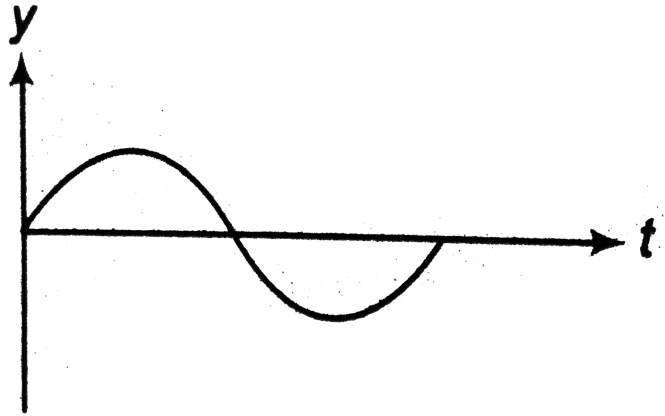
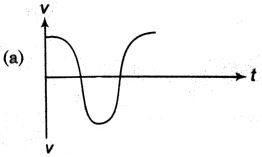
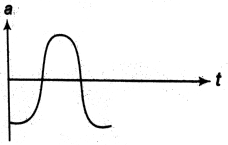
6. Corresponding to $y - t$ graph of a transverse harmonic wave shown in figure,



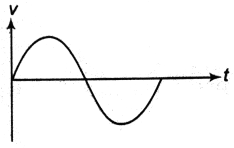
A.



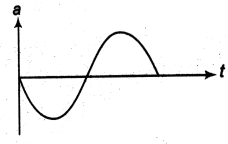
B.



C.



D.



Answer: A::D

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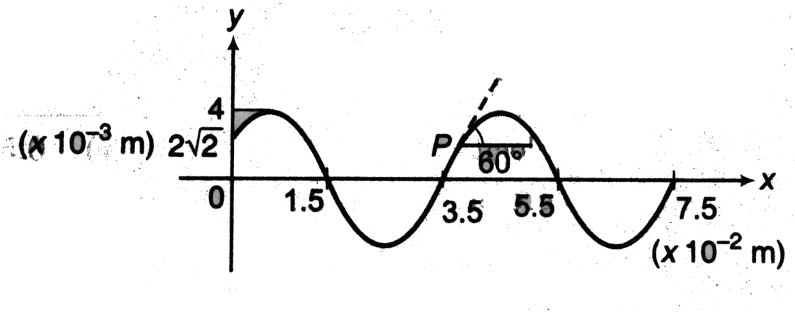
Level 2 Subjective

1. The figure shows a snap photograph of a vibrating string at $t = 0$. The particle P is observed moving up with velocity $20\sqrt{3}cm/s$. The tangent at P makes an angle 60° with x-axis.



(a) Find the direction in which the wave is moving.

(b) Write the equation of the wave.

(c) The total energy carries by the wave per cycle of the string. Assuming that the mass per unit length of the string is $50g/m$.

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2. A long string having a cross- sectional area $0.80mm^2$ and density $12.5gcm^{-3}$ is subjected to a tension of 64 N along the X-axis. One end of this string is attached to a vibrator moving in transverse direction at a frequency fo 20Hz. At t = 0. the source is at a maximujm displacement y= 1.0 cm. (a) Write the equation for the wave. (b) What is the displacement of the particle of the string at x = 50 cm at time t = 0.05 s ? (c) What is the velocity of this particle at this instant ?

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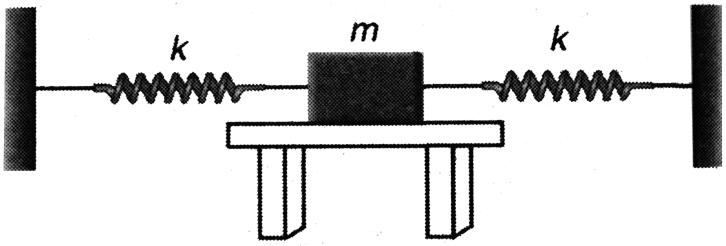
3. One end of each of two identical springs, each of force constant $0.5N/m$ are attached on the opposite sides the a wooden block of mass $0.01kg$. The other ends of the spring are connected to separate rigid supports such that the springs are unstrtched and are collinear in a horizontal plane. To the wooden piece is fixed a pointer which touches a vertically moving plane paper. The wooden piece kept on a smooth horizontal table is now displaced by $0.02m$ along the line of springs and

released. If the speed of paper is $0.1m/s$, find the equation of the path traced by the pointer on the paper and the distance between two consecutive maximum on this path.



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4. A wave pulse is travelling on a string with a speed v towards the positive X-axis. The shape of the string at t = 0 is given by $g(x) = A\sin\left(\frac{x}{a}\right)$, where A and a are constants. (a) What are the dimensions of A and a ? (b) Write the equation of the wave for a general time 1, if the wave speed is v.

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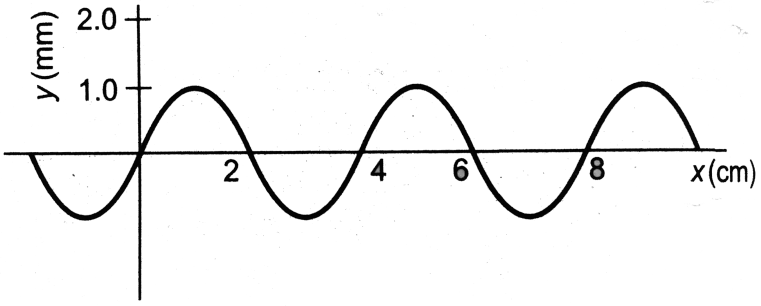
5. Figure shows a plot of the transverse displacement of the particle of a string at $t = 0$ through which a travelling wave is passing in the positive in the positive x-direction. The wave speed is $20cm/s$. Find (a) the amplitude (b) the wavelength (c) the wave number and (d) the frequency of the wave.



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6. Two wires of different densities but same area of cross-section are soldered together at one end and are stretched to a tension T. The velocity of a transverse wave in the first wire is double of that in the second wire. Find the ratio of density of the first wire to that of the second wire.

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7. A sinusoidal transverse wave travel on a string. The string has length $8.00m$ and mass $6.00g$. The wave speed is $30.0m/s$ and the wavelength is $0.200m$. (a) If the wave is to have an average power of $50.0W$, what must be the amplitude of the wave? (b) For the same string, if the ampitude and wavelength are the same as in part (a) what is the average power for the wave if the tension is increased such that the wave speed is doubled?

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Subjective Questions

1. Two long strings A and B, each having linear mass density 1.2×10−2kgm−1, are stretched by different tensions 4.8 N and 7.5 N respectively and are kept parallel to each other with their left ends at x = 0. Wave pulses are produced on the strings at the left ends at t = 0 on string A and at t = 20 ms on string B. When and where will the pulse on B overtake that on A ?

A. which languageisthis

B.

C.

D.

Answer: A::B

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2. A uniform rope with length L and mass m is held at one end and whirled in a horizontal circle with angular velocity ω. You can ignor the force of gravity on the rope. Find the time required for a transverse wave to travel from one end of the rope to the other.

Hint: $\int \frac{dx}{\sqrt{a^2-(x^2)}} = \sin^{-1}\left(\frac{x}{a}\right)$

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JEE MAINS

1. A transverse periodic wave ona strin with a linear mass density of 0.200kg/m is described by the following equations

$y = 0.05 \sin(420t - 21.0x)$

where x and y in metres and t is in seconds. Tension in the string is

A. 32N

B. 42N

C. 66N

D. 80N

Answer: D

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2. A wire of density $9gm/cm^3$ is stretched between two clamps 1.00m apart while subjected to an extension of 0.05cm. The lowest frequency of transverse vibration in the wire is (Assume Yong's modulus $Y = 9 \times 10^{10} N/m^2$.

A. 35Hz

B. 45Hz

C. 75Hz

D. 90Hz

Answer: A

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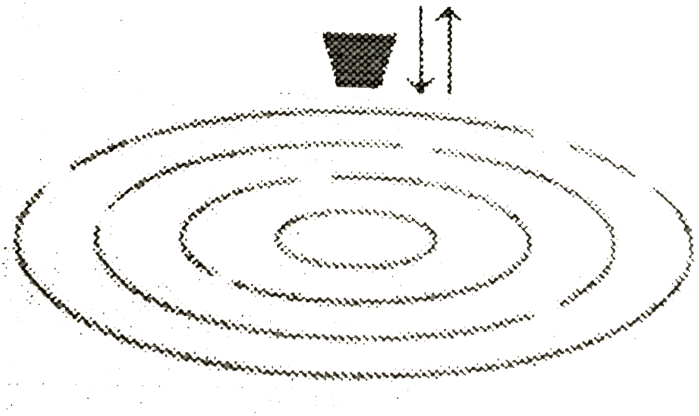
3. A piece of cork is foating on water in a small tank. The cork oscillates up and doen vertically when small ripples pass over the surface of water. The velocity of the ripples being $0.21ms^{-1}$, wavelength 15mm and amplitude 5mm, the maximum velocity of hte piece of cork is



A. $0.44ms^{-1}$

B. $0.24ms^{-1}$

C. $2.4ms^{-1}$

D. $4.4ms^{-1}$

Answer: A

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4. A person is talking in a small room and the sound intensity level is 60dB everywhere within the room. If there ar eight people talking simultaneously in the room, what is the sound intensity level?

A. 96dB

B. 69dB

C. 74dB

D. 81dB

Answer: B

Watch Video Solution

5. The fundamental frequency of a closed organ pipe is sam eas the first overtone freuency of an open pipe. If the length of open pipe is 50cm, the length of closed pipe is

A. 25cm

B. 12.5cm

C. 100cm

D. 200cm

Answer: B

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6. The second overtone of an open pipe A and a closed pipe B have the same frequencies at a given temperature. Both pipes contain air. The ratio of fundamental frequency of A to the fundamental frequency of B is:

(A)$3:5$ (B)$5:3$ (C)$5:6$ (D)$6:5$

A. $3:5$

B. $5:3$

C. $5:6$

D. $6:5$

Answer: B

Watch Video Solution

7. A resonance tube is resonated with tunning fork of frequency 256Hz. If the length of foirst and second resonating air coloumns are 32 cm and 100cm, then end correction will be

A. 1cm

B. 2cm

C. 4cm

D. 6cm

Answer: B

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8. A tunning fork is frequency 512Hz is vibrated with a sonometer wire and 6 beats per second as heard The beat frequency reduces if the tension in the string of slightly increased. The original frequency of vibration of the string is

A. 506Hz

B. 512Hz

C. 518Hz

D. 524Hz

Answer: A

Watch Video Solution

9. A closed organ pipe and an open organ pipe of same length produce 4 beats when they are set into vibration simultaneously. If the length of each of them were twice their initial lengths. The number of beats produced will be [Assume same mode of viberation in both cases]

A. 2

B. 4

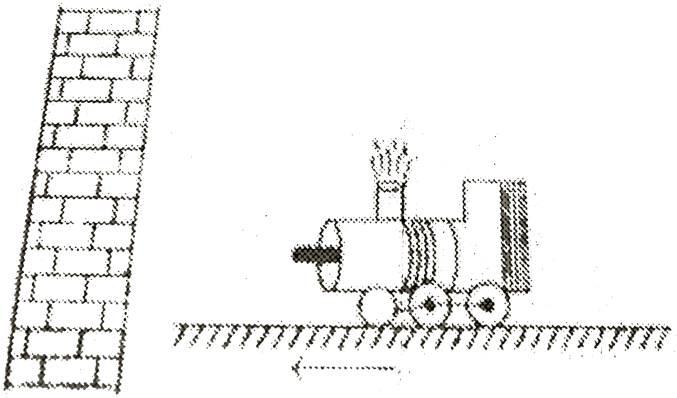
C. 1

D. 8

Answer: A

Watch Video Solution

10. An engine driver moving towards a wall with velocity of $50ms^{-1}$ emits a note o frequency 1.2kHz. The frequyency of note after reflection from the wall is eard by the engine driver when speed of sound in air is $350ms^{-1}$ is



A. 1kHz

B. 1.8kHz

C. 1.6kHz

D. 1.2kHz

Answer: C

Watch Video Solution

11. two trains move towards each other sith the same speed. The speed of sound is 340 m/s. If the height of the tone of the whistle of one of them heard on the other changes 9/8 times, then the speed of each train should be

A. $10ms^{-1}$

B. $40ms^{-1}$

C. $20ms^{-1}$

D. $15ms^{-1}$

Answer: C

Watch Video Solution

12. A taut string at both ends viberates in its n^{th} overtone. The distance between adjacent Node and Antinode is found to be 'd'. If the length of the string is L, then

A. (a) $L = 2d(n+1)$

B. (b) $L = d(n+1)$

C. (c) $L = 2dn$

D. (d) $L = 2d(n-1)$

Answer: A

Watch Video Solution

13. A person can hear frequencies only upto 10kHz. A steel piano pipe wire 50cm long of mass 5g is streched with a tension of 400N. The number of the hightest overtone of the sound produced by this plano wire that the person can hear is

A. 48

B. 50

C. 49

D. 51

Answer: C

Watch Video Solution

14. A chord attached to a viberating tunning fork divides it into 6loops, when its tension is 36N. The tensin at which it will viberate in 4loops is

A. 24N

B. 36N

C. 64N

D. 81N

Answer: D

Watch Video Solution

15. A string, fixed at both ends, vibrates in a resonant mode with a separation of 2.0 cm between the consecutive nodes. For the next higher

resonant frequency, this separation is reduced to 1.6 cm. Find the length of the string.

A. 4.0cm

B. 8.0cm

C. 12.0cm

D. 16.0cm

Answer: B

Watch Video Solution

16. In case of closed organ pipe, which harmonin the p^{th} overtone will be

A. 2p+1

B. 2p-1

C. p+1

D. p-1

Answer: A

Watch Video Solution

17. A source frequency f gives 5 beats when sounded with a frequency 200Hz. The second harmonic of same source gives 10 beats when sounded with a source of frequency 420Hz. The value of f is

A. (a)200Hz

B. (b)210Hz

C. (c)205Hz

D. (d)195Hz

Answer: C

Watch Video Solution

18. Two open organ pipes of fundamental frequencies n_1 and n_2 are joined in series. The fundamental frequency of the new pipes so obtained will be

A. (a) $n_1 + n_2$

B. (b) $\frac{n_1 n_2}{n_1 + n_2}$

C. (c) $\frac{n_1 + n_2}{2}$

D. (d) $\sqrt{\left(n_1^2 + n_2^2\right)}$

Answer: B

Watch Video Solution

19. Speed of transverse wave in a string of density $100 kg / m^3$ and area of cross-section $10 mm^2$ under a tension of 10^3 N is

A. 100m/s

B. 1000m/s

C. 200m/s

D. 2000m/s

Answer: B

Watch Video Solution

20. Speed of sound wave in a gas V_1 and rms speed of molecules of the gas at the same temperature is v_2.

A. $v_1 = v_2$

B. $v_1 < v_2$

C. $v_1 > v_2$

D. $v_1 \leq v_2$

Answer: B

Watch Video Solution

21. The ratio of intensities between two cohernt sound sources is 4:1. The difference of loudness is decibel (bD) between maximum and minimum intensitiesm, when they interface in space is

A. 10 log2

B. 20 log3

C. 10 log3

D. 20 log2

Answer: B

Watch Video Solution

22. A closed organ pipe and an open organ pie of same length produce four bets in their fundamental mode when sounded together, If length of the open organ pipe is increased, then the number of beats will

A. increase

B. decrease

C. remain constant

D. may increase or decrease

Answer: D

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23. The equation of a travelling wave is given as $y = 5\sin 10\pi(t - Q.01x)$, along the x-axis . Here, all quantities are in SI units. The phase difference between the points separated by a distance of 10m alond x-axis is

A. $\frac{x}{2}$

B. π

C. 2π

D. $\frac{\pi}{4}$

Answer: B

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24. How many time are taken intense is 90dB sound than 40dB sound?

A. 5

B. 50

C. 500

D. 10^5

Answer: D

Watch Video Solution

25. The equation of a wave disturbance is given as $y = 0.02\cos\left(\frac{\pi}{2} + 50\pi t\right)\cos(10\pi x)$, where x an y are in metre and t in second. Choose the wrong statement.

A. Antinode occurs at x=0.3

B. The wave length is 02m

C. The speed of the consituent is 4m/s

D. Node occurs at x=0.15m

Answer: C

Watch Video Solution

26. For a certain organ pipe three successive resonance frequencies are observed at 425Hz, 595 Hz and 765Hz respectively. If the speed of sound air is 340m/s, then the length of the pipe is

A. 2.0m

B. 0.4m

C. 1.0m

D. 0.2m

Answer: C

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27. A source of sound of frequency 600Hz is placed inside of water. The speed of sound is water is $1500m/s$ and air it is $300m/s$. The frequency of sound recorded by an observer who is standing in air is

A. 200Hz

B. 3000Hz

C. 120Hz

D. 600Hz

Answer: D

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28. A heavy rope is suspended from a rigid support A wave pulse is set up at the lower end, then

A. the pulse will travel with uniform speed

B. the pulse will travel with increasing speed

C. the pulse will travel with decreasing speed

D. the pulse cannot travel through the rope

Answer: B

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29. Which of the following is not the standard from of a sine wave?

A. $y = A \sin 2\pi \left(\frac{t}{T} - \frac{x}{\lambda} \right)$

B. $y = A \sin(vt - kx)$

C. $y = A \sin \omega \left(t - \frac{x}{V} \right)$

D. $y = A \sin k(vt - x)$

Answer: B

Watch Video Solution

30. The speed of sound wave in a gas, in which two waves of wavelengths 1.0m and 1.02m produce 6 beats per second is

A. 300m/s

B. 306m/s

C. 380m/s

D. 410m/s

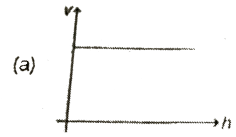
Answer: B

Watch Video Solution

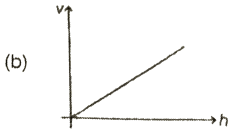
31. A Uniform rope having mass m hags vertically from a rigid support. A transverse wave pulse is produced at the lower end. The speed v of wave

pulse varies with height h from the lower end as

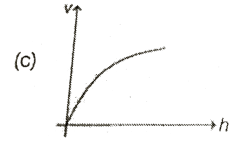
A.



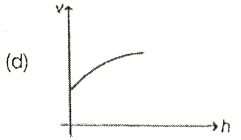
B.



C.



D.



Answer: C

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32. A string of length L is stretched by $L/20$ and speed transverse wave alon it is v. The speed of wave ehen it is stretched by $L/10$ will be

(assume that Hooke law is applicable)

A. 2v

B. $\frac{v}{\sqrt{2}}$

C. $\sqrt{2}v$

D. 4v

Answer: C

Watch Video Solution

33. Two identical sounds s_1 and s_2 reach at a point P phase. The resultant loudness at a point P is not higher than the loudness of s_1. The value of n is

A. 2

B. 4

C. 5

D. 6

Answer: D

Watch Video Solution

34. A source of frequency 10kHz when viberted over than mouth of a closed organ is in unison at 300K. The beats produced when temperature rises by 1K

A. 30Hz

B. 13.33Hz

C. 16.67Hz

D. 40Hz

Answer: C

Watch Video Solution

35. If λ_1, λ_2 and λ_3 are the wavelengths of the wave giving resonance with the fundamental, first and second overtones respectively of a closed organ pipe Then the ratio of wavelength λ_1, λ_2 and λ_3 is

A. $1:2:3$

B. $1:\frac{1}{3}:\frac{1}{5}$

C. $1:3:5$

D. $5:3:1$

Answer: B

Watch Video Solution

36. An open and a closed pipe have same length ratio of frequencies of their nth overtone is

A. $\frac{n+1}{2n+1}$

B. $\frac{2(n+1)}{2n+1}$

C. $\frac{n}{2n+1}$

D. $\frac{n+1}{2n}$

Answer: B

Watch Video Solution

37. A sufficiently long closed organ pipe has a small hole at its bottom. Initially the pipe is empty. What poured into the pipe at a constant rate. The fundamental frequency of the air column in the pite

A. continously increases

B. first incrases and then becomes constant

C. continously decreases

D. first decrease and then become constant

Answer: B

Watch Video Solution

38. A string 1 has twice the length, twice the radius, twice the tension and twice the density of another string 2. The relation between the fundamental frequency of 1 and 2 is

A. $f_1 = 2f_2$

B. $f_1 = 4f_2$

C. $f_2 = 4f_1$

D. $f_1 = f_2$

Answer: C

Watch Video Solution

39. A wave representing by the equation $y = A\cos(kx - \omega t)$ is suerposed with another wave to form a stationary wave such that point $x = 0$ is a node. The equation for the other wave is

A. $y_2 = -A\sin(kx - \omega t)$

B. $y_2 = -A\cos(kx + \omega t)$

C. $y_2 = A\sin(kx - \omega t)$

D. $y_2 = A\cos(kx - \omega t)$

Answer: B

Watch Video Solution

40. 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 wil be

(A)8 (B)7 (C)4 (D)2

A. 8

B. 7

C. 4

D. 2

Answer: B

Watch Video Solution

41. Velcity of sound in an open organ pipe of 330m/s. The frequency of wave is 1.1 kHz and the length of tube is 30cm. To which harmoninc does this frequency corresponds?

(A)2nd (B)3rd (C)4th (D)5th

A. 2nd

B. 3rd

C. 4th

D. 5th

Answer: A

Watch Video Solution

42. First overtone frequency of a closed organ pipe is equal to the first overtone frequency of an open organ pipe. Further nth harmonic of closed organ pipe is also equal to the mth harmonic of open pipe, where n and m are

(A)5,4 (B)7,5 (C)9,6 (D)7,3

A. 5,4

B. 7,5

C. 9,6

D. 7,3

Answer: C

Watch Video Solution

43. Two sound waves have intensities of 10 and $500\mu / cm^2$. How many desibel is the second sound louder than the first?

A. 7dB

B. 1.7dB

C. 2.7dB

D. 3.7dB

Answer: B

Watch Video Solution

44. In a stationary wave that forms as a result of reflection of wave from an obstacle, the ratio of this amplitude at an antinode to the amplitude at anode is n. The ratio of energy reflected to energy incident is

A. $\left(\frac{n-1}{n^2}\right)$

B. $\left(\frac{n-1}{n+1}\right)^2$

C. $\left(\frac{1}{n}\right)^2$

D. $\left(\frac{n}{n+1}\right)^2$

Answer: B

Watch Video Solution

45. A travelling wave is partly reflected and partly transmitted from a rigid boudary. Let $a_i, a_r \text{ and } a_t$ be the amplitude of incident wave, reflected wave and transmitted wave and $I_i, I_r \text{ and } I_t$ be the corresponding intensities. Then choose the correct alternatives

A. $\frac{l_i}{l_r} = \left(\frac{a_i}{a_r}\right)^2$

B. $\frac{l_i}{l_t} = \left(\frac{a_i}{a_r}\right)^2$

C. $\frac{l_r}{l_t} = \left(\frac{a_r}{a_t}\right)^2$

D. All the above

Answer: A

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46. Equations of a stationery and a travelling waves are $y_1 = a \sin kx \cos \omega t$ and $y_2 = a \sin(\omega t - kx)$ The phase differences between two between $x_1 = \frac{\pi}{3k}$ and $x_2 = \frac{3\pi}{2k} are \phi_1$ and ϕ_2 respectvely for the two waves. The ratio $\frac{\phi_1}{\phi_2}$ is

A. 1

B. $\frac{5}{6}$

C. $\frac{3}{4}$

D. $\frac{6}{7}$

Answer: D

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47. A steel rod 100 cm long is clamped at its centre. The fundmental frequency of longitudinal viberations of the rod are given to be 2.53kHz. What is the speed of sound is steel?

A. $10.06 kms^{-1}$

B. $5.06 kms^{-1}$

C. $15.06 kms^{-1}$

D. $2.42 kms^{-1}$

Answer: B

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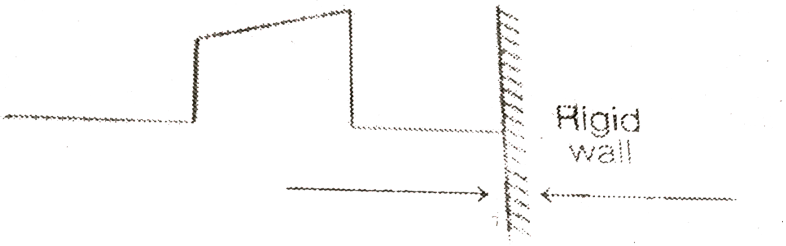
48. A pulse is incident on a rigid walt. The possible from of reflected pulse is



A.

B. 

C. 

D. 

Answer: C

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49. A uniform wire of density ρ is stretched by $l_!$ under its propotional limit whose original slength is L. What is lowest frequency of transverse viberation set up in the wire assuming Young's modulus of the material to be Y?

A. $\frac{1}{2L}\sqrt{\frac{Yl_1}{\rho L}}$

B. $\frac{1}{4L}\sqrt{\frac{Yl}{\rho L_1}}$

C. $\frac{1}{2L}\sqrt{\frac{Yl_1}{\rho L_1}}$

D. $\frac{1}{L}\sqrt{\frac{Yl_1}{\rho L}}$

Answer: A

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50. A taut string for which mass per unit length $\mu = 5.0 \times 10^{-2} kg/m$ is under tension of 80N. How much power in watt upto one decimal points must be supplied to the string to generate siusodial be supplied to the string to generate sinusoidal wave at a frequency of 6.0Hz and amplitude of 6.00cm

A. 5.2W

B. 10.4W

C. 2.6W

D. 7.8W

Answer: A

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ONLY ONE OPTION IS CORRECT

1. The frequency of sonometer wire is f. The frequency becomes $f/2$ when the mass producing the tension is completely immersed in water and on immersing the mass in a certain liquid, frequency becomes $f/3$. The relative density of the liquid is

A. $\frac{4}{3}$

B. $\frac{16}{9}$

C. $\frac{15}{12}$

D. $\frac{32}{27}$

Answer: D

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2. in a plane progaressive harmonic wave particle speed is always less than the wave speed if.

A. amplitude of wave is less than $\frac{\lambda}{2\pi}$

B. amplitude of wave is greater than $\frac{\lambda}{2\pi}$

C. amplitude to wave is less than λ

D. amplitude of wave is greater than $\frac{\lambda}{\pi}$)

Answer: A

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3. in an experiment it was found that string vibrates in n loops when a mass M is placed on the pan. What mass should be placed on the pan to make it vibrate in 2n loops with same frequency ? (neglect the mass of pan)

A. 2m

B. $\frac{m}{4}$

C. 4M

D. $\frac{M}{2}$

Answer: B

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4. two pipes have each of length 2 m, one is closed at on end and the other is open at both ends. The speed of sound in air is 340 m/s . The frequency at which both can resonate is ?

A. 340 Hz

B. 510 Hz

C. 42.5 Hz

D. none of these

Answer: D

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5. An open organ pipe of length l is sounded together with another open organ pipe of length l + x in their fundamental tones. Speed of sound in air is v. the beat frequency heard will be ($x < < l$)

A. $\frac{vx}{4/^2}$

B. $\frac{vl^2}{2x}$

C. $\frac{vl}{2/^2}$

D. $\frac{vl^2}{2l}$

Answer: C

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6. Two sound sources are moving in opposite directions with velocities v_1 and $v_2(v_1 > v_2)$. Both are moving away from a stationary observer. The frequency of both the sources is 900 Hz. What is the value of $v_1 - v_2$ so that the beat frequency aboserved by the observer is 6 Hz. speed of sound v= 300 m/s given ,that v_1 and $v_2 < < v$

A. 1m/s

B. 2m/s

C. 3m/s

D. 4 m/s

Answer: B

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7. the frequency changes by 10 % as the source approaches a stationary observer with constant speed v_s. What would be the percentage change

in frequency as the sources reaccedes the observer with the same speed ?

Given , that $v_s << v$(v= speed pf sound in air)

A. 14. 3 %

B. 0.2

C. 16 . 7 %

D. 0.1

Answer: D

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8. when a source of sound of frequency f crosses stationary observer with a speed $v_s(<<$ speed of sound v) , the apparent change in frequency Δf is given by

A. $\frac{2fv_s}{v}$

B. $2fsv_s$

C. $\frac{2fv_s}{v_s}$

D. $\frac{fv_s}{v}$

Answer: A

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9. the maximum pressure variation that the human ear can tolerate in loud sound is about $30N/m^2$. The corresponding maximum displacement for a sound wave ina air having a frequency of $10^3 Hz$is take velocity of sound in air as 300 m/s and density of air $1.5kg/m^3$

A. $\frac{2\pi}{3} \times 10^{-2}m$

B. $\frac{2 \times 10^{-4}}{\pi}m$

C. $\frac{\pi}{3} \times 10^{-2}m$

D. $\frac{10^{-4}}{3\pi}m$

Answer: D

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10. A transverse wave $y = 0.05\sin(20\pi x - 50\pi t)$ meters , is propagating along + ve X - axis on a string light insect starts crawling on the string with velocity of 5 cm /s at t= 0 along the +ve X - axis from point where x = 5 cm . After 5 s the difference in phase of its position is equal to

A. 150π

B. 250π

C. -245π

D. -5π

Answer: B

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11. If l_1 and l_2 are the lengths of air column for the first and second resonance when a tuning fork frequency n is sounded on a resonance tube, there the distance of the antinode from the top end of resonance tube is

A. $2(l_2 - l_1)$

B. $\frac{1}{2}2(l_1 - l_2)$

C. $\frac{l_2 - 3l_1}{2}$

D. $\frac{l_2 - l_1}{2}$

Answer: C

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12. A sonometer wire resonates with a given tuning fork forming standing waves with five antitodes between the two bridges when a mass of $9kg$ is suspended from the wire. when this same tuning fork forming three antitodes for the same positions of the bridges. the value of M is

A. 12 kg

B. 5 kg

C. 12 . 5 kg

D. 25 kg

Answer: A

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13. identical wires A and B of different materials are hung from then ceiling of a room . The density of wire A is greater than the density of wire B but their lengths are same. Identical wave pulses are produced at the bottom of respective wires. The time taken by the pulse to reach the top is

A. greater for wire A

B. greater for wire B

C. same for both the wires

D. cannot be determind

Answer: C

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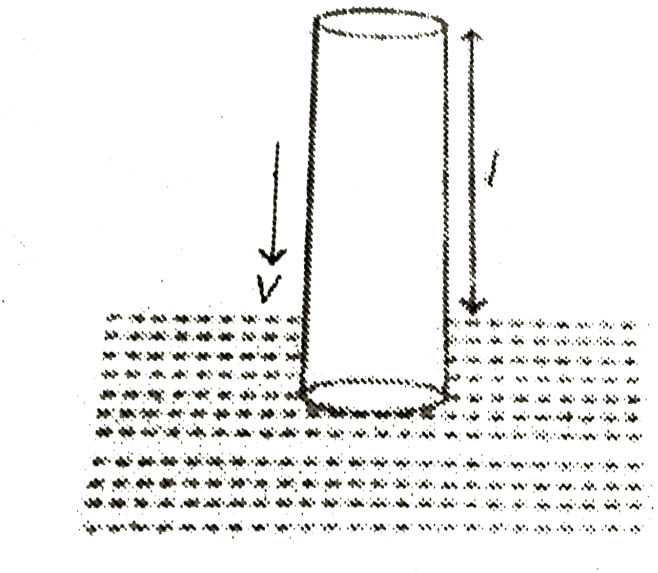
14. An open pipe of sufficient length is dipping in water with a speed v vertically. If at any instant l is lengths of tube avoce water. Then the rate at which fundamental frequency of pipe changes , is (speed of sound = c)



A. $\frac{CV}{2l^2}$

B. $\frac{CV}{4l^2}$

C. $\frac{C}{2v^2l^2}$

D. $\frac{C}{4v^2l^2}$

Answer: B

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15. A 10 W source of sound of frequency 1000 Hz sends out wave in air. The displacment amplitude at a distance of 10 m from the source is (speed of sound in air = 340 m/s and density of air = 129 $k\frac{g}{m^3}$)

(A)$0.62\mu m$ (B)$4.2\mu m$ (C)$1.6\mu m$ (D)$0.96\mu m$

A. 0.62 μm

B. $4.2\mu m$

C. $1.6\mu m$

D. $0.96\mu m$

Answer: D

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16. The amplitude of a wave disturbance propagating along positive X-axis is given by $y = \frac{1}{1+x^2}$ at t=0 and $y = \frac{1}{1+(x-2)^2}$ at t=4 s where x

and y are in metre. The shape of wave disturbance does not change with time. The velocity of the wave is

A. 1 m/s

B. 0.5 m/s

C. 2 m/s

D. 4 m/s

Answer: B

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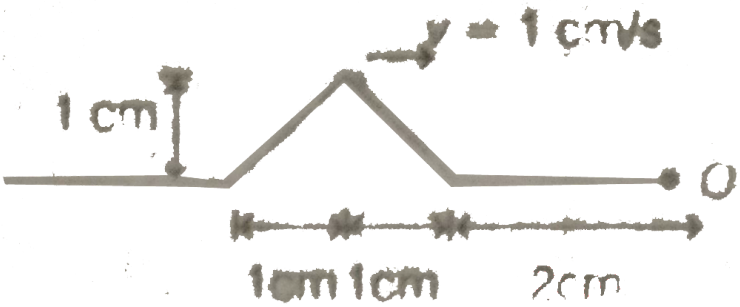
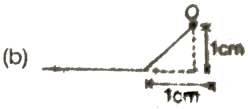
17. A wave pulse on a string on a string has the dimension shown in figure. The wave speed is v=1 cm /s . If point O is a free end. The shape of

wave at time t = 3s si

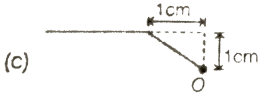


A.

B.



C.



D.

Answer: D

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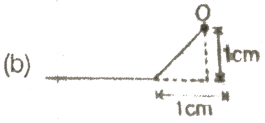
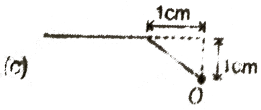
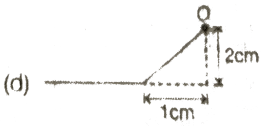
18. in the above problem , shape of the wave at time t = 3 s if . O is a fixed end will be

A. 

B. 

C. 

D. 

Answer: A

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19. A string of length $0.4m$ and mass $10^{-2}kg$ is tightly clamped at its ends. The tension in the string is $1.6N$. Identical wave pulse are produced

at one end at equal intervals of time, Δt. The minimum value of Δt which allows constructive interference of successive pulse is

A. 0.05 s

B. 0.10 s

C. 0.20 s

D. 0.40 s

Answer: B

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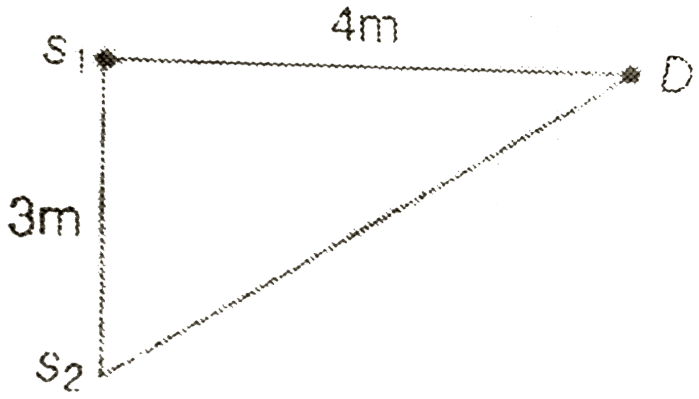
20. In the figure , the intensity of waves arriving at D from two coherent soucrces s_1 and $s_2 is I_0$. The wavelength of the wave is $\lambda = 4m$.

Resultant intensity at D will be



A. (a)$4l_0$

B. (b)l_0

C. (c)$2l_0$

D. (d)zero

Answer: C

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21. A tuning fork of 512 Hz is used to produce resonance in a resonance tube experiment . The level of water at first resonance is 30. 7 cm and at

second resonance is 63 . 2 cm . The error in calculating velocity of sound is (speed of sound in air = 330 m/s)

A. 204.1 cm/s

B. 110 cm/s

C. 58 cm/s

D. 280 cm /s

Answer: D

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22. the equation for the vibration of a string fixed both ends vibration in its third harmonic is given by

y = 2 cm sin $\left[\left(0.6cm^{-1}x\right) \times \right]\cos\left[\left(500ps^{-1}t\right]\right.$ What is the position of node?

A. 24.6 cm

B. 12.5 cm

C. 20 . 6 cm

D. 15. 7 cm

Answer: D

Watch Video Solution

23. A string is under tension sot that its length uncreased by $\frac{1}{n}$ times its original length . The ratio of fundamental frequency of longitudinal vibrations and transverse vibrations will be

A. 1:n

B. $n^2 : 1$

C. $\sqrt{n} : 1$

D. n:1

Answer: C

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24. the frequency of a sonometer wire is 100 Hz. When the weight producing th tensions are completely immersed in water the frequency becomes 80 Hz and on immersing the weight in a certain liquid the frequency becomes 60 Hz. The specific gravity of the liquid is

A. 1.42

B. 1.77

C. 1.82

D. 1.21

Answer: B

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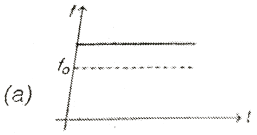
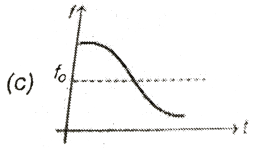
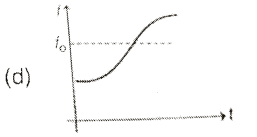
25. source and observer both start moving simultaneously from origion one along y - axis with speed of source = 2 (speed of observer). The graph

between the apparent frequency observed by observer (f) and time (t) would be

A. 

B.

C. 

D. 

Answer: B

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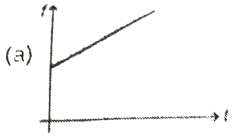
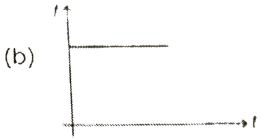
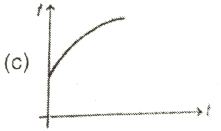
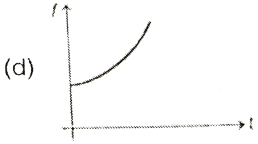
26. An observer starts moving with unifrom acceleration a towards a stationary sound soure of frequency f_o. As the observer approaches the

source ,the apparent frequency f heard by the observer varies with time t as

A. 

B. 

C. 

D. 

Answer: A

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27. Speed of sound wave is v. If a reflector moves towards a stationary source emitting waves of frequency f with speed u, the wavelength of

reflected waves will be

A. $\frac{v-u}{v+u}f$

B. $\frac{v+u}{v}f$

C. $\frac{v+u}{v-u}f$

D. $\frac{v-u}{v}f$

Answer: C

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28. A train is moving with a constant speed along a circular track. The engine of the train emits a sound of frequency f. The frequency heard by the guard at the rear end of the train.

A. is less than f

B. is greter than f

C. is equal to f

D. may be greater than , less than or equal to f denpending on the factors like speed of train, legth of train and radius of circular track

Answer: C

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29. A conveyor belt moves to the right with speed v=300 m/min. A pieman puts pies on the belt at a rate of 20 per minute while walking with speed 30 m/min towards a receiver at the other end. The frequency with which they are received by the stationary receiver is

A. 26.67 / min

B. 30/ min

C. 22.22 / min

D. 24 / min

Answer: C

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30. Equations of two progressive waves are given by $y_1 = a\sin(\omega t + \phi_1)$ and y_(2) = asin (omegat +phi_(2)) $If amplitude$ and $time period of rest an t wave are same as t\hat{o} f \perp h the waves$ (phi_(1) -phi_(2))` is

A. $\frac{\pi}{3}$

B. $\frac{2\pi}{3}$

C. $\frac{\pi}{6}$

D. $\frac{\pi}{4}$

Answer: B

Watch Video Solution

31. A transverse sine wave of amplitude 10 cm and wavelength 200 cm travels from left to right along a long horizontal stretched, string with a

speed of 100 cm/s. Take the origin at left end of the string. At time t = 0 the left end of the string is at the origin and is moving downward. Then the equation of the wave will be (in CGS system)

A. $y = 10\sin(0.01\pi \times \ - \pi t)$

B. $y = 10\sin(\pi t - 0.01\pi \times)$

C. $y = 10\sin(0.02\pi \times \ - 0.01\pi t)$

D. $y = 10\sin(\pi t - 0.02\pi \times)$

Answer: A

Watch Video Solution

32. A string of mass 0.2 kg/m and length l= 0.6 m is fixed at both ends and stretched such that it has a tension of 80 N. the string vibrates in 3 segments with maximum amplitude of 0.5 cm. the maximum transverse velocity amplitude is

A. 1.57 m/s

B. 6. 28 m/s

C. 3.14 m/s

D. 9.42 m/s

Answer: A

Watch Video Solution

33. A string fixed at both is vibrating in the lowest mode of vibration for which a point at quarter of its length from one end is a point of maximum displacement . The frequency of vibration emitted when it vibrates in the next mode such that this point is again a point of maximum displacement ?

A. 400 Hz

B. 200 Hz

C. 600 Hz

D. 300 hz

Answer: D

Watch Video Solution

34. two sound waves moves in the same direction .if the average power transmiitted across a cross - section by them are equal while their wavelengths are in the ratio of 1:2 . Their pressure amplitudes would be in the ratio of

A. 1

B. 2

C. 4

D. $\frac{1}{2}$

Answer: A

Watch Video Solution

35. the fundamental frequency of a sonometer wire of length is f_0.A bridge is now introduced at a distance of $\Delta l$from the centre of the wire $(\Delta l < < l)$. The number of beats heard if their fundamental mode are

A. $\frac{8f_0\Delta|}{|}$

B. $\frac{f_0\Delta|}{|}$

C. $\frac{2f_0\Delta|}{|}$

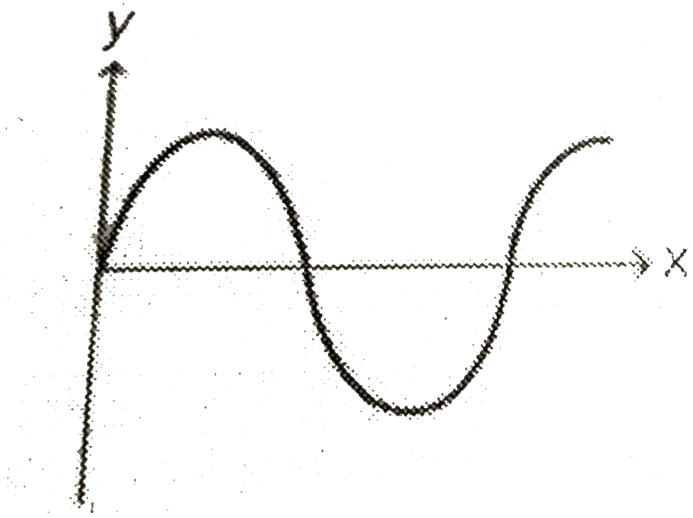
D. $\frac{4f_0\Delta|}{|}$

Answer: A

Watch Video Solution

36. in a sine wave ,postive of different particles at time t=0 is shown in figure. The equation for this wave if it is travelling along postive x -axis

can beB



A. $y = A\sin(\omega t - kx)$

B. $y = A\sin(kx - \omega t)$

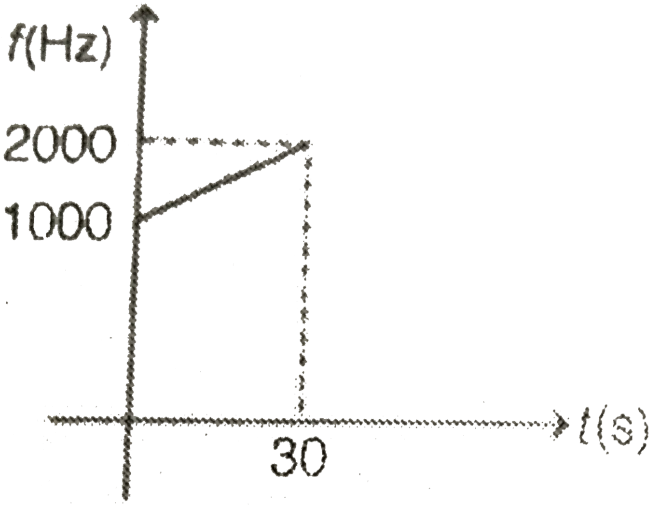
C. $y = A\cos(\omega t - kx)$

D. y= A cos (kx- omega-t)`

Answer: B

Watch Video Solution

37. A detector is released from rest over a source of sound of frequency $f_0 = 10^3 Hz$. The frequency observed by the detector at time t is plotted in the graph. The speed of sound in air is $(g = 10m/s^2)$



A. 330m/s

B. 350 m/s

C. 300 m/s

D. 310 m/s

Answer: C

Watch Video Solution

38. A standing wave is maintained in a homogeneous string of cross - sectional area a and density p . It is formed at y\he superpositions given of two waves travelling in opposite directions given by the equations

A. $\frac{3\pi sp\omega^2 a^2}{2k}$

B. $\frac{\pi sp\omega^2 a^2}{2k}$

C. $\frac{5\pi sp\omega^2 a^2}{2k}$

D. $\frac{2\pi sp\omega^2 a^2}{2k}$

Answer: C

Watch Video Solution

39. A 100 Hz sinusoidal wave is travelling in the positve x - direaction along a string with a linear mass density of $3.5 \times 10^{-3} kgm^{-1}$ and a tension of 35 N. At time t =0 ,the point x=0 has zero displacment and the slope of the string is $\pi / 20$then select the wrong alternative.

A. velcoity of wave is 100 m/s

B. angular velocity is (200π) rad /s

C. Amplitude of wave is 0.025 m

D. none of the above

Answer: D

Watch Video Solution

40. At t=0 , observer and source are at same place. Now the source is projected with velocity $60\sqrt{2}$m/s at 45° . Natural frequency of source is 1000 Hz.find the frequency heard by the observer at t=2s. Take speed of sound = 340 m/s

A. 930 Hz

B. 860 Hz

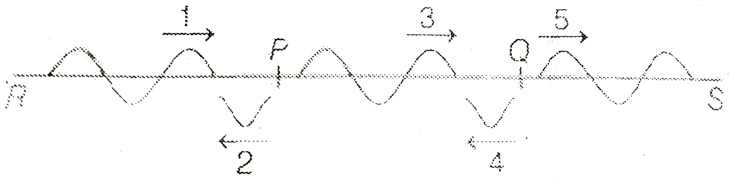
C. 826 Hz

D. 970Hz

Answer: C

Watch Video Solution

41. there are three strings RP, Pqand QS as shown. Their mass and length are RP = (0.1 kg , 2 m), PQ = (0.2 kg , 3 m) ,QS= (0.15 kg , 4 m) respectively. All the strings are under the same tension. Wave -1 is incident at P. it is partly reflected (wave -2) adn partly transmitted (wave -3) . now wave - 3 is incident at Q . it is again partly transmitted (wave -5)[and partly reflected (wave -4) . phase difference between wave -1 and wave



A. 2 is π

B. 4 is zero

C. both (a) and (b) are correct

D.

Answer: C

Watch Video Solution

42. minimum frequency of audible sound is 20 Hz and maximum frequency is 20 , 000 Hz. If we compare the sound levels of these two frequencies of same amplitudes, their difference will be

A. 30 dB

B. 60 dB

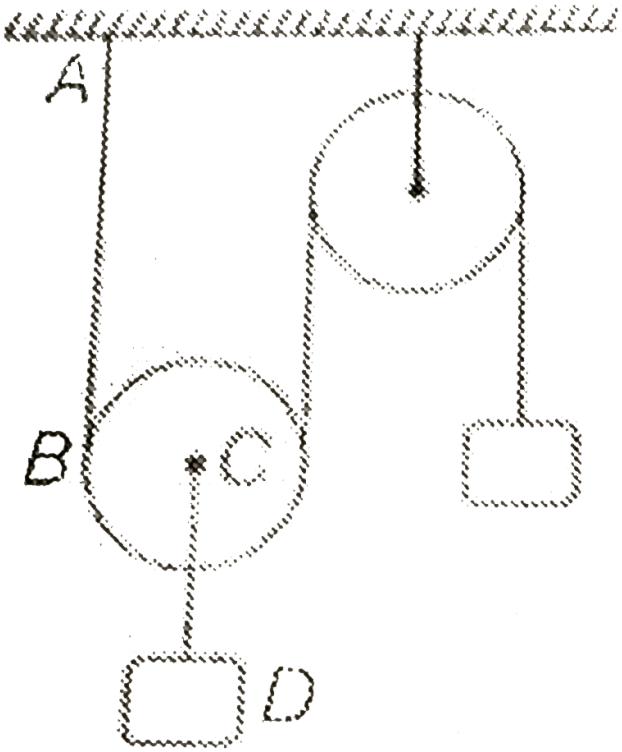
C. 90 dB

D. 120 dB

Answer: B

Watch Video Solution

43. both the strings , shown in figure are made of same material and have same cross - section. The pulleys are light the wave speed pf a travsverse wave in the string AB is v_1 and in CD is v_2. The ratio v_1 / v_2 is



A. 1

B. 2

C. $\sqrt{2}$

D. $1\sqrt{2}$

Answer: D

Watch Video Solution

44. A stone in hung in air from a wire which is stretched over a sonometer . The bridges of the sonometer are $40cm$ apart when the wire is in unison with a tuning fork of frequency $256Hz$. When the stone is completely immersed in water , the length between the bridges is $22cm$ for re - establishing unison . The specific gravity of the material of the stone is

A. $\frac{(40)^2}{(40)^2+(22)^2}$

B. $\frac{(40)^2}{(40)^2-(22)^2}$

C. $\frac{(40)^2+(22)^2}{(40)^2}$

D. $\frac{(40)^2-(22)^2}{(40)^2}$

Answer: B

Watch Video Solution

45. A heavy but unifrom rope of length L is suspended from a celling . A particle is dropped from the celling at the instant when the bottom end is given a transverse wave pulse. Where will the particle meet the pulse.

A. at a distance $\frac{2l}{3}$ form the bottom

B. at a distance $\frac{L}{3}$ from the bottom

C. at a distance $\frac{3L}{4}$ from the bottom

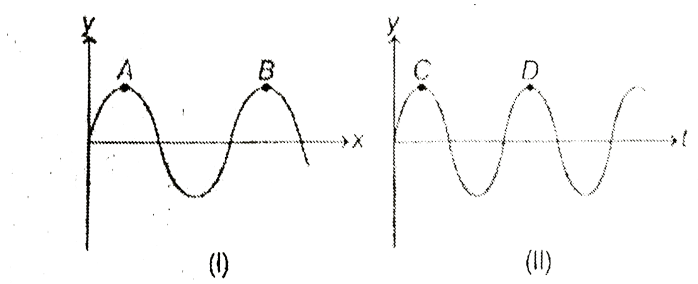
D. none of the above

Answer: B

Watch Video Solution

46. the same progressive wave is reprsented by two group I and II. Graoup I shows how the displacement 'y' varies with the distance x along the wave at a given time. Graph II shows how y varies with time t at a given point on the wave. The ratio of measurements AB to CD, marked on the

curvse m repersents.



(a) wave number k
(b) wave speed V
(c) frequency f
(d) angular frequency ω

A. wave number K

B. wave speed V

C. frequecny f

D. angular fequecy ω

Answer: B

Watch Video Solution

47. A string of length 'L' is fixed at both ends . It is vibrating in its $3rd$ overtone with maximum amplitude 'a'. The amplitude at a distance $L/3$

from one end is

A. a

B. 0

C. $\frac{\sqrt{3}a}{2}$

D. $\frac{a}{2}$

Answer: C

Watch Video Solution

48. A wire having a linear density of $0.05g/cm$is stretched between two rigid supports with a tension of $450N$. It is observed that the wire resonates at a frequency of $420Hz$. The next higher frequency at which the same wire resonates is $490Hz$. Find the length of the wire.

A. 314 cm

B. 254 cm

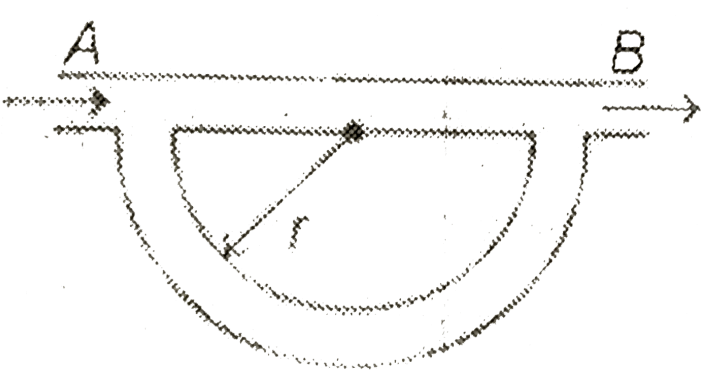
C. 214 cm

D. 354 cm

Answer: C

Watch Video Solution

49. sound singal is sent through a compostie tube as shown in the figure. The radius of the semicrcular portion of the tube is r, speed of sound in air is v, the source of sound is capable of giving varied frequencies . If n is an integaer then frequnecy for maximum intensity is given by



A. $\frac{nv}{r}$

B. $\frac{nv}{t(\pi-2)}$

C. $\frac{nv}{\pi r}$

D. $\frac{nv}{(r-2)\pi}$

Answer: B

Watch Video Solution

50. A tube of diameter d and of length l is open a both ends. Its fundamental frequnecy of resonance is found to be f_1. One end of the tube is now closed. The lowrst frequency of resonance of this closed tube is now f_2. Taking into consideration the end correction , $\frac{f2}{f_1}$ is

A. $\frac{(l+0.6d)}{(l+0.3d)}$

B. $\frac{(l+0.3d)}{2(l+0.6d)}$

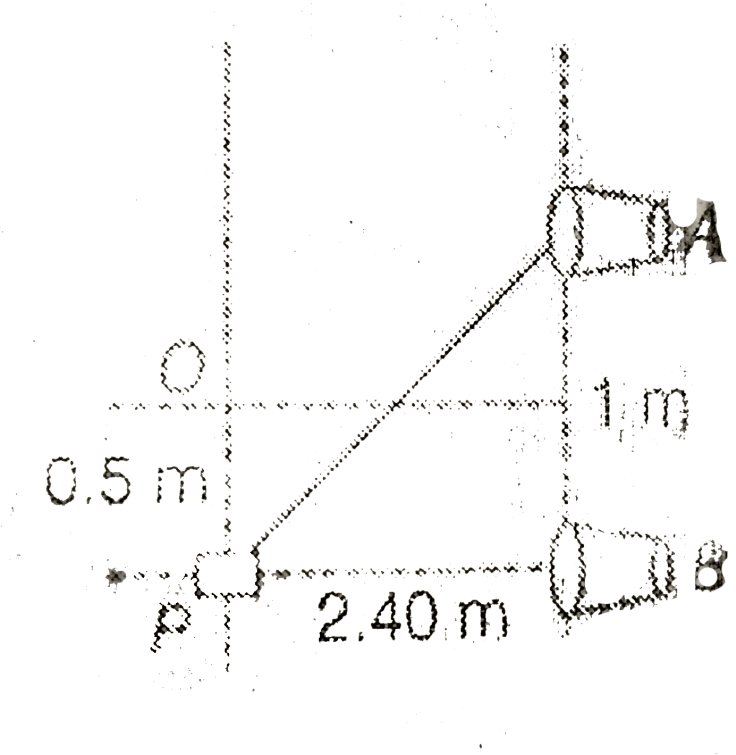
C. $\frac{(l+0.6d)}{2(l+0.3d)}$

D. $\frac{1(d+0.3l)}{2(d+0.6l)}$

Answer: C

Watch Video Solution

51. two speakers A and B , placed 1 m apart, each produces sound waves of frequnecy 1800 Hz. In phase. A detector moving parallel to line of speakers distant 2.4 m away detects a maximum intensity at O nd then at P. speed of sound wave is



A. $330ms^{-1}$

B. $360ms^{-1}$

C. $350ms^{-1}$

D. $340ms^{-1}$

Answer: B

Watch Video Solution

52. A soure of sound of frequency 165 Hz generates sound waves which get fully reflected from a wall . A person standing at the wall starts moving away from the wall. The minimum distance of the point from the wall at which the person hears maximum sound is (velcoity of sound = 330 ms^{-1})

A. 1m

B. 2 m

C. 1/2 m

D. 1/4 m

Answer: A

Watch Video Solution

53. bullets are fixed at regualr intervals of 10 second from a car moving with a speed of $30ms^{-1}$ towards another car approaching with a speed of 60 m/s . The interval at which the firing can be reported is (Speed of sound = $330ms^{-1}$

A. 7.7 s

B. 8.32 s

C. 6.7 s

D. 12 s

Answer: A

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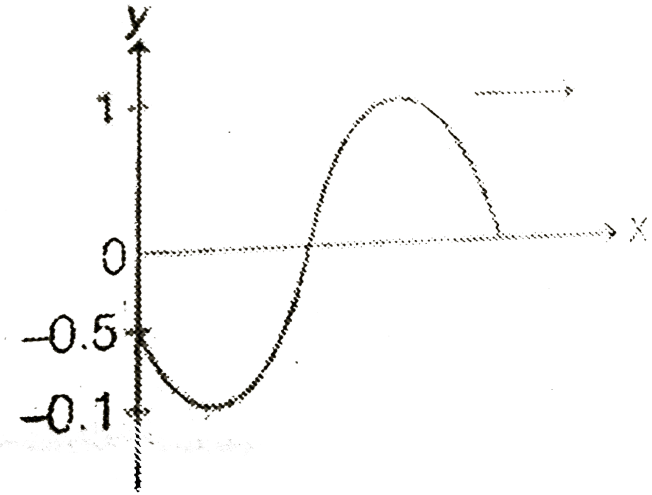
54. the equation of a wave travelling along the positive x - axis ,as shown in figure at t = 0 is given by



A. $\sin\left(kx - \omega t + \frac{\pi}{6}\right)$

B. $\sin\left(kx - \omega t - \frac{\pi}{6}\right)$

C. $\sin\left(\omega t - kx + \frac{\pi}{6}\right)$

D. $\sin\left(\omega t - kx - \frac{\pi}{6}\right)$

Answer: D

Watch Video Solution

55. A closed organ pipe of radius r_1 and an open organ pipe of radius r_2 and having same length 'L' resonate when excited with a given tuning

fork. Closed organ-pipe resonates in its fundamental mode where as open organ pipe resonates in its first overtone, then :-

A. $r_2 - r_1 = L$

B. $r_2 - r_1 = L/2$

C. $r_2 - 2r_1 = 2.5L$

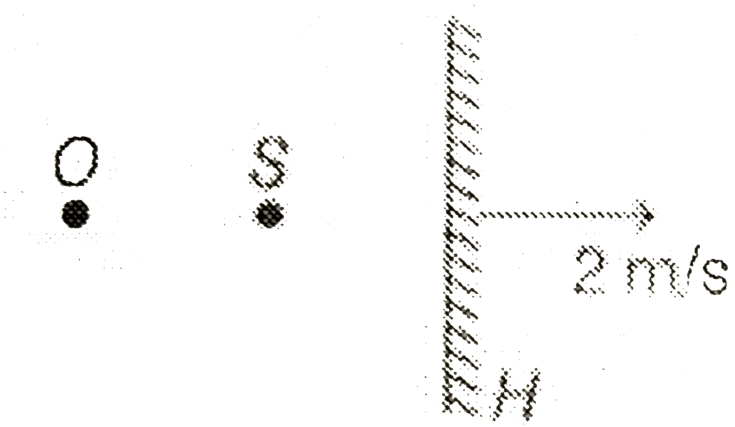
D. $2r_2 - 2r_1 = 2.5L$

Answer: C

Watch Video Solution

56. A stationary sound sound 's' of frequency 334 Hz and a stationary ovserver 'O' are placed near a reflecting suface moving away from the source with velocity 2 m/s as shown in the figure. If the velocity of the

sound waves is air is v= 330 m/s the apparent frequency of the echo is



A. 332 Hz

B. 326 Hz

C. 334 Hz

D. 330 Hz

Answer: D

Watch Video Solution

57. A sounding body emitting a frequency of $150H_Z$ is dropped from a height. During its fall under gravity it crosses a balloon moving upwards

with a constant velocity of $2m/s$ one second after it started to fall . The difference in the frequency observer by the man in balloon just before and just afer crossing the body will be (velocity of sound $= 300m/s$, $g = 10m/s^2$)

A. 12

B. 6

C. 8

D. 4

Answer: A

Watch Video Solution

58. A soure of sound of frequency 165 hz is placed in front of a wall at a distance 2 m from it. A dtector is also placed in front of the wall at the same distance from it. Find the minimum distance between the source and detector for which maximum sound is recorded int he detector . the speed of sound is 330 m/s

A. 4m

B. 3 m

C. 1 m

D. 2m

Answer: B

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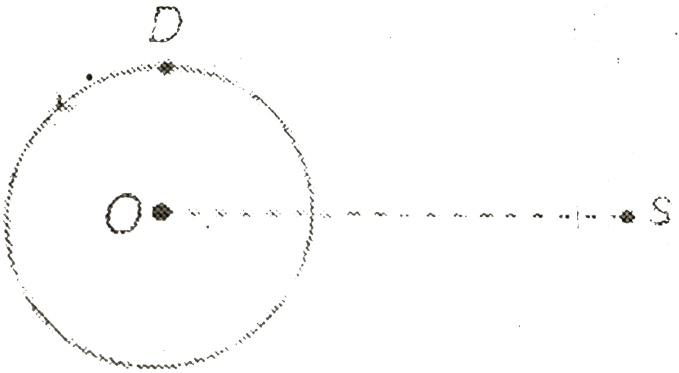
59. A sound detector D moves with constant speed on a circle or radius R and centre at O in xy plane. A point source of sound S lines in xy plane at a distance 2R from the point O and emits sound of a given frequency . The ratio of maximum frequency and minimum frequency recorded by the detector is $\frac{11}{9}$ and speed of sound is 340 m/s . the minimum time interval in seconds between recording a maximum frequency and

minimum frequency is (take R = 17)



A. $1:2$

B. $1:3$

C. $1:1$

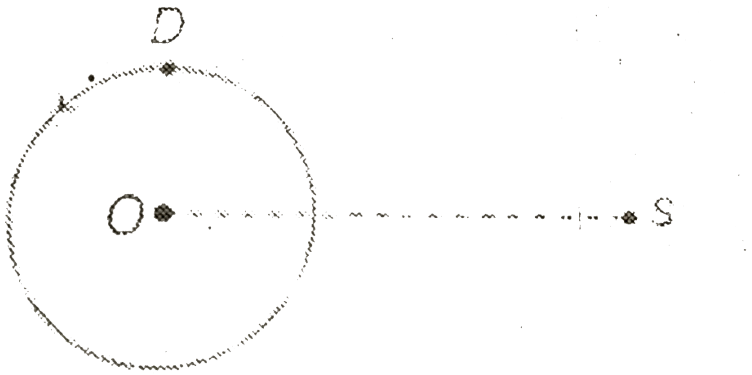
D. $2:3$

Answer: B

Watch Video Solution

60. A sound detector D moves with constant speed on a circle or radius R and centre at O in xy plane. A point source of sound S lines in xy plane at

a distance 2R from the point O and emits sound of a given frequency . The ratio of maximum frequency and minimum frequency recorded by the detector is $\frac{11}{9}$ and speed of sound is 340 m/s . the minimum time interval in seconds between recording a maximum frequency and minimum frequency is (take R = 17)



A. 3

B. $\pi/3$

C. $\pi/2$

D. $2\pi/3$

Answer: A

Watch Video Solution

61. Two notes A and B sounded together produce 2 beats per second. When notes B and C are sounded together 3 beats with per second are produced. The notes A and C separately produce the same number of beats with a standard tuning fork of frequnecy 456 Hz. the possible frequency of note B is

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62. An open organ pipe is vibrating in its fifth overtone. The distance between two consecutive pionts where pressure amlitude is $\frac{1}{\sqrt{2}}$ times pressure amplitude at pressure antinodes,is 40 cm , then the length of open organ pipe is (neglect end connection)

A. 3 cm

B. 3.6 cm

C. 4.2 cm

D. 4.8 cm

Answer: C

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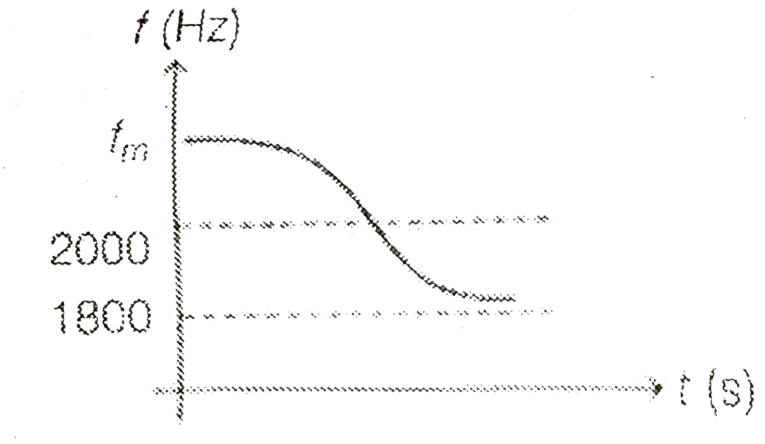
More Than One Option is Correct

1. A stationary observer receiver a sound of frequency $f_0 = 2000Hz$ .Sourece is moving with constant velocity on a road at some non-zero prependicular distance from observer . The apparent frequncy f varies with times as show in figure . Speed of sound $= 300m/s$. Find the maximum apparent frequency.



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2. The equation $y = 4 + 2\sin(6t - 3x)$ represents a wave motion with

A. amplitude 6 units

B. amplitude 2 units

C. wave speed 2 units

D. wave speed $1/2$ units

Answer: B::C

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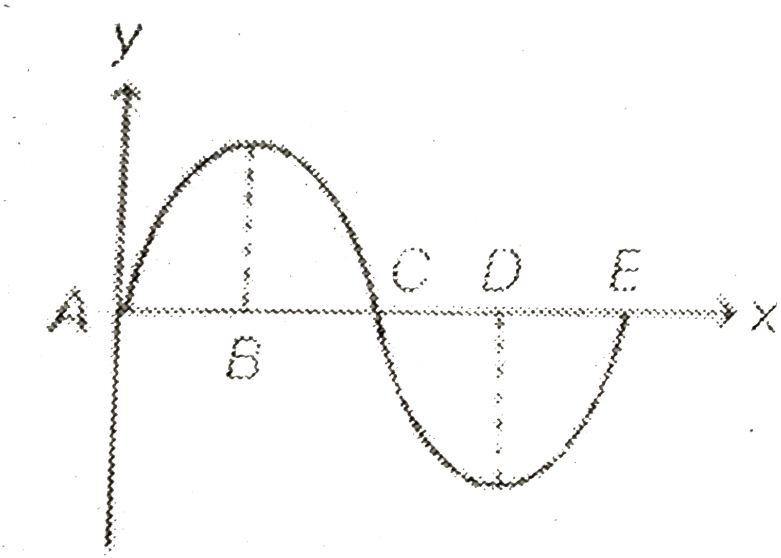
3. Sound wave is travellimg along positive x -direction . Displacement (y) of particles from their mean position at position x is a shown in figure .

Choose the correct alternative(s).



A. Particle located at tE has its velocity in negative x-direction

B. Particle located at D has zero velocity

C. Change in pressure at D is zero

D.

Answer: A::B::C::D

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4. A closed organ pipe of length 1.2 m vibrates in its first overtone mode . The pressue variation is maximum at

A. 0.8m from the open end

B. 0.4m from the open end

C. closed end

D. 1.0m from the open end

Answer: B::C

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5. PROGRESSIVE WAVES

A. phase difference between displacement and accleration of particle is zero

B. Phase difference bwteen displacement and acceleration of particle is π

C. phase difference between between displacement and velocity of particle is $\pi/2$

D. phase difference between velocity and acceleration of particle is $\pi/2$

Answer: B::C::D

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6. The equation of a wave distrubance is a given as $y = 0.02\sin\left(\frac{\pi}{2} + 50\pi t\right)\cos(10\pi x)$, where x and y are in metre and t is in second . Choose the correct statement (s).

A. The wavelength of wave is 0.2m

B. Displacement node occurs at x=0.15xm

C. Displacement antinode occurs at x=0.3m

D. The speed of constitutent wave is 0.2m/s

Answer: A::B::C

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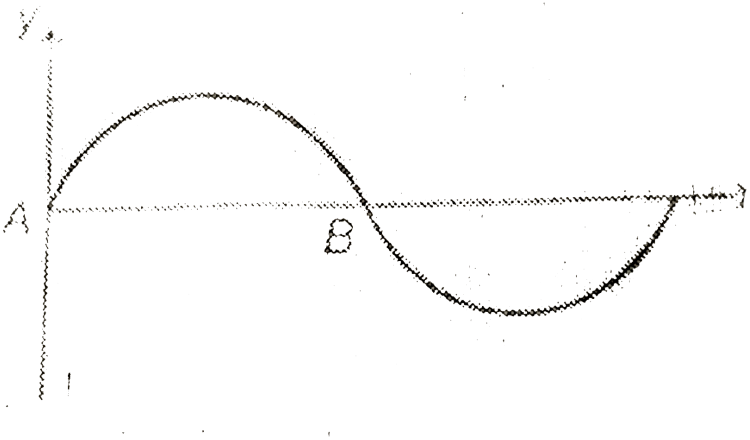
7. The figure show an instantaneous profile of a rope carrying a progressive wave moving from left to right , then



A. A is moving downwards

B. A is moving downwards

C. A is moving upwards

D. A is moving upwards

Answer: A::D

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8. The tension in a stretch string fixed at both ends is changed by 2%, the fundarmental frequency is founder to get changed by 1.5 Hz . Select the correct statement(s).

A. Wave length of the string of fundamental frequency does not change

B. Velocity of propagation of wave length changes by 2%

C. Velocity of propagation of wave changes by 1%

D. Original frequency is 1500Hz

Answer: A::C::D

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9. The equational of a stationary wave in a string is $y = (4mm)\sin\left[\left(314m^{-1}x\right]\cos\omega t\right.$. Select the correct alternative (s).

A. The amplitude of component waves in 2mm

B. The amplitude of componen wave is 4mm

C. The smallest possible length of string is 0.5m

D. The smallest possible length of string is 1.0cm

Answer: A::D

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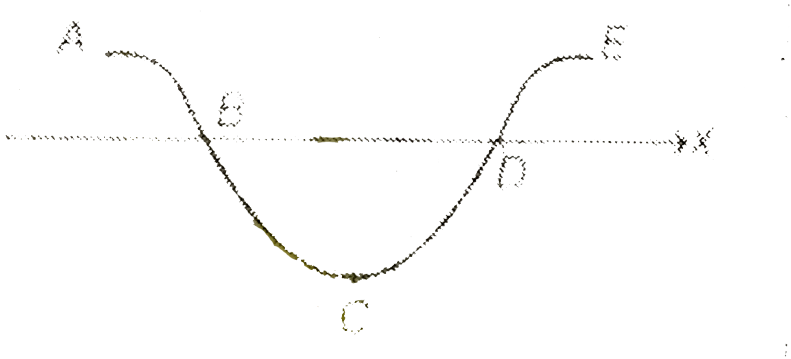
10. The figure represent a longitudinal wave length travelling in positive x-direction . Then



(A)part ABC represent compression

(B)part ABC represent rarefraction

(C)part CDE represent compression

(D)part CDE represent rarefraction

A. part ABC represent combination

B. part ABC represent rearefraction

C. part CDE represent compression

D. part CDE represent rerefraction

Answer: A::D

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11. WHICH OF THE FOLLOWING FUNCTIONS OF X AND T REPRESENTS A PROGRESSIVE WAVE ?

A. Y=SIN (4T-3X)

B. $y = \frac{1}{4 + (4T - 3X)^2}$

C. Y = $\frac{1}{4T + 3X}$

D. 1/(4T+3X)`

Answer: A::B

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12. The equation of a wave travelling on a string is given by Y(mn) = 8 sin[$(5m^{-1}x - (4s^{-1}t]$. Then

A. velocity of wave is 0.8 m/s

B. the displacement of a particle of the sting at t= 0 and $x = (30)$ m from the mean position is 4 m

C. the displacement of th mean position at t = 0, $x = (30)$m is 8 m

D. velocity of the wave is 8 m/s

Answer: A::B

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13. For a certain stretched string, three consecutive resonance frequencies are observed as 105, 175 and 245 Hz respectively. Then, the fundamental frequency is

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14. A wave equation which given the dispplacement along the y-direction is given by ,

$y = 10^{-4}\sin(60t + 2x)$

where x and y are in matre and t is time in second. This represents a wave

A. travelling with a velocity of 30 m/s in the negative x- direction

B. of wavelength (π)m

C. of frequency $30/(\pi)$ Hz

D. of amplitube 10^{-4}

Answer: A::B::C::D

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15. An air column in a pipe, when is closed at one end, is in resonance with a vibrating tuning fork of frequency $264H_Z$. If $\upsilon = 330m/s$, the length of the column in cm is (are)

A. 31.25

B. 62.5

C. 93.75

D. 125

Answer: A::C

Watch Video Solution

16. Velocity of secnod in air is 320 m/s. Neglecting end correctionss, the air column in the pipe can resonate for sound of frequency

A. 80 Hz

B. 240 Hz

C. 320 Hz

D. 400 Hz

Answer: A::B::D

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17. The plane wave represented by an eqution of the form y = f(x-vt) implies the propagation along the positive x-axis without chang of shape with constant velocity v. Then

A. $\frac{\partial y}{\partial t} = -v\left(\frac{\partial y}{\partial x}\right)$

B. $\frac{\partial y}{\partial t} = -v\left(\frac{\partial^2 y}{\partial x^2}\right)$

C. $\frac{\partial^2 y}{\partial t^2} = -v^2\left(\frac{\partial^2 y}{\partial x^2}\right)$

D. $\frac{\partial^2 y}{\partial t^2} = v^2\left(\frac{\partial^2 y}{\partial x^2}\right)$

Answer: A::C

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18. S_1 and S_2 are two sources of sound emitting sine waves. The two sources are in phase. The sound emitted by the two sources interfers at point F. The waves of wavelength :

A. 1 m will result in constructive interference

B. $\frac{2}{3}$ m will result in constructive interference

C. 2 m will result in destructive interference

D. 4 m will result in destructive interference

Answer: A::B::D

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19. Two narrow organ pipes, one open (length l_1) and the other closed (length l_2) are sounded in their respective fundamental modes. The beat frequency heard is $5Hz$. If now the pipes are sounded in their first overtones, then also the beat frequency heard is $5Hz$. Then:

A. $\frac{l_1}{l_2} = \frac{1}{2}$

B. $\frac{l_1}{l_2} = \frac{1}{1}$

C. $\frac{l_1}{l_2} = \frac{3}{2}$

D. $\frac{l_1}{l_2} = \frac{2}{3}$

Answer: B::C

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20. Given are two tuning forks near one another. One of them is of unknown frequency and the other is of frequency 591 Hz.We can hear beat of maximum intensity $I_0$with frequency 5 Hz. At t = 0 we hear a maxima. Then

A. Unknown frequency can be 596 Hz

B. Unknown frequency can be 586 Hz

C. Intersity at time t = 2.7 s is /0

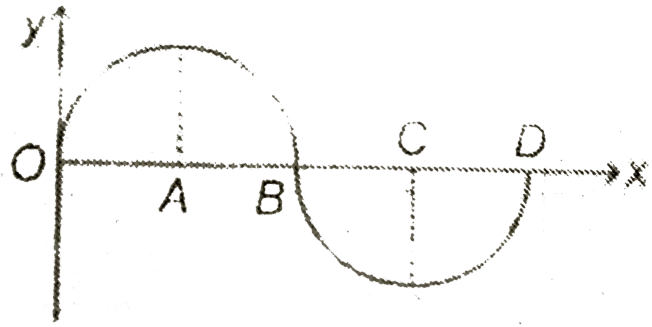
D. Intensity at time t = $\frac{27}{20}$s is $\left(\frac{0}{2}\right)$

Answer: A::B::D

Watch Video Solution

21. A longitudinal sine wave is travelling in air along positive x-direction. Displacement(s) of particles from their mean positions at a particular

time t are shown in the figure. Choose the correct options for that



instant only

A. Particle located at C has zero velocity .

B. Particle located at C is equal to normal atmospheric direction

C. The pressure at C is equal to normal atmospheric pressure .

D. Particles located near B are under compression.

Answer: A::B::C::D

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22. Two very long string are tied together at the point x = 0 In region x lt 0, the wave speed is v_1,while in the region x gt0, the speed is v_2. A sinusoidal wave is incident on the knot from the left(x lt 0). Part of the

wave is redlected and part is transmitted. For X lt 0 the the displacement of the wave is described by y(x,t) = A sin($K_1x - wt$)+B sin ($k_1x + wt$), while for x gt 0, y(x,t)=Csin (K_1)$x - wt$, where $w/k_1 = v_1$and $w/k_2 = v_2$. Which of the following is /are correct .

A. $\frac{C}{A} = \frac{2v_2}{v_1 + v_2}$

B. $\frac{B}{A} = \frac{v_2 - v_1}{v_1 + v_2}$

C. $B^2 + \frac{v_1}{v_2}C^2 = A^2$

D. A^(2)+(v^(1))/(v_(2))C^(2)=B^(2)`

Answer: A::B::C

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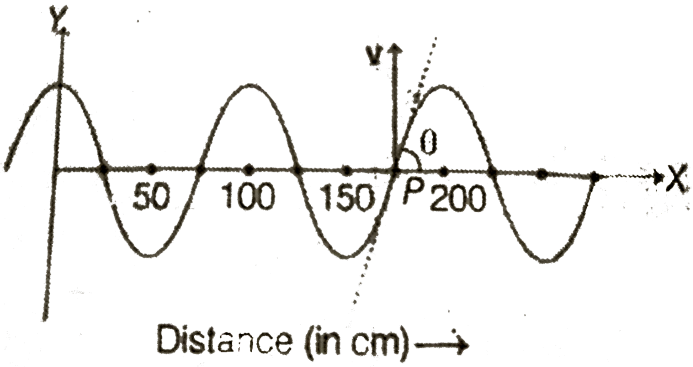
23. Shape of a string transmitting wave along x-axis some instant is shown. Velocity of point P v - (4π)cm /s (θ) = $\tan^{-1}$(0.004pi`)



A. Amplitube of wave is 2 mm

B. Velocity of wave is 10 m/s

C. Maximum acceleration of particle is $80\pi^2 cm/\sec^2$

D. Wave is travelling in negative x-direction

Answer: A::B::C::D

Watch Video Solution

Comprehion Type Questions

1. [Q.Nos. 1-2] y(x, t) equation of a lingiutudinal wave is given as

$y = 10^{-2}2(\pi)\left[1000t + \frac{50}{17}x\right]$ (All Si units

At t = 0 Change in pressure is maximum at x=.....m.

A. 0.34

B. 0.255

C. 0.085

D. All of these

Answer: A

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2. y(x, t) equation of a lingitudinal wave is given as

$y = 10^{-2}2(\pi)\left[1000t + \frac{50}{17}x\right]$ (All Si units

If density of the gas is $10^{-3}kg/m^3$, find the pressure amplitube

A. $200.62N/m^2$

B. 421.24N/m^2

C. 100.26 N/m^2

D. 21.36 N/m^2

Answer: D

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3. [Q. Nos. 3-4] Difference in frequencies between 3rd overtone of closed pipe and 5th haronic of the same pipe is 400 Hz. Futher 3rd hormonic of this closed pipe os equal to 6th hormonic of another open pipe.

Fundamental frequencies of closed pipe and open pipe are: a) 200 Hz, 400 Hz b) 150 Hz, 75 Hz c) 200 Hz, 100Hzz d) 400 Hz, 300Hz

A. 200 Hz, 400 Hz

B. 150 Hz, 75 Hz

C. 200 Hz, 100 hz

D. 400 Hz, 300 Hz

Answer: C

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4. [Q. Nos. 3-4] Difference in frequencies between 3rd overtone of closed pipe and 5th harmonic of the same pipe is 400 Hz. Further 3rd hormonic of this closed pipe is equal to 6th hormonic of another open pipe. If speed sound is 330 m/s. Then lengths of closed pipe and open pipe are a) 0.4125 m, 0.825 m b) 3.3m, 1.65 m c) 0.825 m, 0.825 m d) 1.65 m, 0.825 m

A. 0.4125 m, 0.825 m

B. 3.3m, 1.65 m

C. 0.825 m, 0.825 m

D. 1.65 m, 0.825 m

Answer: A

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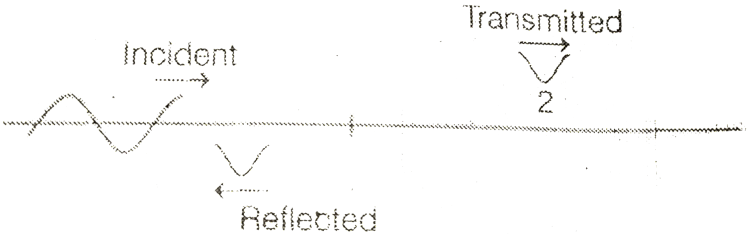
5. In the shown figure answer the following two question.



If P_i, P_r, P_t are powers of incident, reflected and transmitted waves and I_i, I_r, I_t the corresponding intensities , then

A. $P_i = P_r + P_t$

B. $I_i = I_r + I_t$

C. both(a) and (b) are correct

D. both (a) and (b) are wrong

Answer: A

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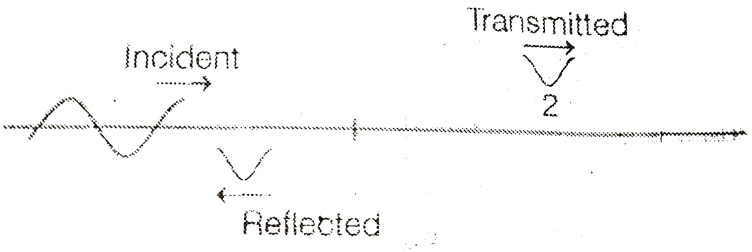
6. [Q.Nos.5-6] In the shown figure answer the following two question.



Under what condition 75% of incident energy transmitted

A. $\frac{V_1}{V_2} = \frac{1}{2}$

B. $\frac{V_1}{V_2} = \frac{1}{3}$

C. $\frac{V_1}{V_2} = \frac{1}{4}$

D. $\frac{V_1}{V_2} = \frac{2}{3}$

Answer: B

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7. [Q. Nos. 7-8] You have three forks A, B, and C Fork B has a frequency of 440 What A and B are sounded together a frequency of 3 Hz is heard.

When B and C sounded together, the beat frequency is 4 Hz. The possible frequencies of C are: a) 437 Hz and 443 Hz b) 436 Hz and 444 Hz c) 436 Hz and 445 Hz d) 437 Hz and 444 Hz

A. 437 Hz and 443 Hz

B. 436 Hz and 444 Hz

C. 436 Hz and 445 Hz

D. 437 Hz and 444 Hz

Answer: B

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8. The possible beat frequencies when A and C are sounded together are

A. 2 Hz and 7 HZ

B. 1 Hz and 6 HZ

C. 1 Hz and 7 HZ

D. 2 Hz and 6 HZ

Answer: C

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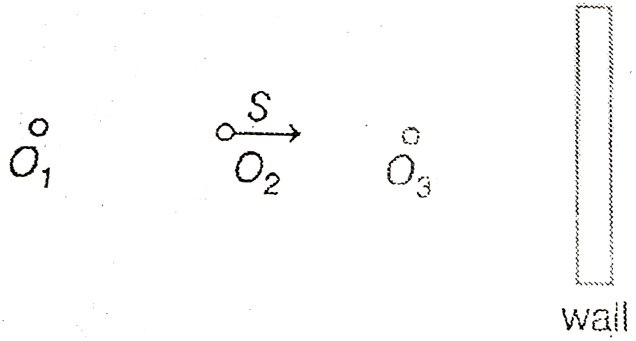
9. A source is approaching towoed a wall as shown in figure .We have three observes O_1, $O_2$and O_3. $observer$O_(2) is over the source itself . Let f_1, f_2 and f_(3) be the beat frequencires heard by O_1, $O_2$and O_3 between direct sound from the source and reflected sound from the wall .



then

A. (a)`f_(3)=0

B. $f_1 > f_2$

C. both(a) and (b) are wrong

D. both (a) and (b) are correct

Answer: D

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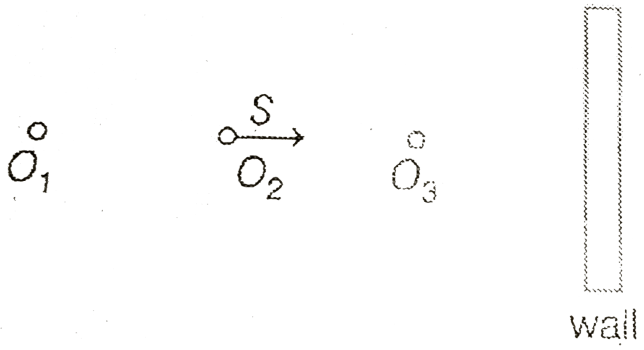
10. Given frequency of source f=100Hz,$v_s = 20m/s$and $v = 330m/s. The beat frequencies f_(1) \text{ and } f_(2)$ are



A. a.$f_1 = 20Hz$

B. b. $f_2 = 10Hz$

C. c. both(a) and (b) are wrong

D. d.both (a) and (b) are correct

Answer: C

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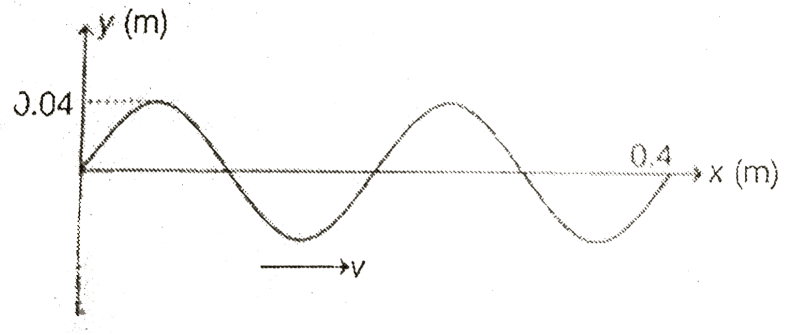
11. The position of a transverse wave travelling in medium along positive x-axis is shown in figure at time t=0. Speed of wave is v=200 m/s

Frequency of the wave is



A. $10^2 Hz$

B. $10^3 Hz$

C. $10^4 Hz$

D. $10^5 Hz$

Answer: B

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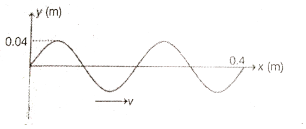
12. The position of a transverse wave travelling in medium along positive x-axis is shown in figure at time t=0. Speed of wave is v=200 m/s

Equation of the wave is (in SI unit)



A. $y = 0.04 \sin 2\pi \left(5 \times \ - 10^3 t\right)$

B. $y = 0.04 \sin 2\pi \left(10^3 t - 5 \times \ \right)$

C. $y = 0.04 \cos 2\pi \left(5 \times \ - 10^3 t\right)$

D. $y = 0.04 \cos 2\pi \left(10^3 t - 5 \times \ \right)$

Answer: A

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13. A string fastened at both ends has successive resonances with wavelengths of 0.1 m for mth harmonic and 0.08 m for (m+1)th harmonic. The value of m is

A. 3

B. 4

C. 5

D. 6

Answer: B

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14. A string fastened at both ends has successive resonances with wavelengths of 0.1 m for mth harmonic and 0.08 m for (m+1)th harmonic. the length of the string is

A. 0.2m

B. 0.4m

C. 0.6m

D. 0.8 m

Answer: A

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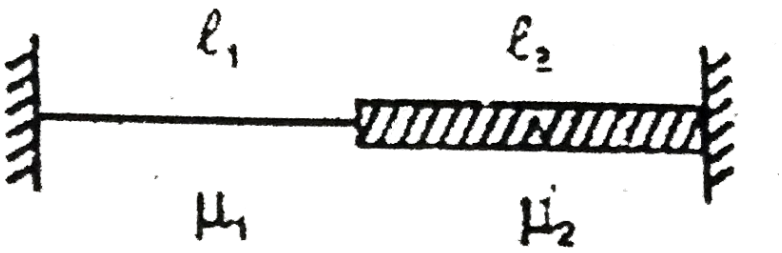
15. A composite wire is made by joining two uniform wires. If $l_1 = l_2 = l$ and $\mu_1 = \frac{\mu_2}{9} = \mu$. Tension in the strings is T , μ is mass per unit length. Then lowest frequency such that the junction is an antinode.



A. $\frac{1}{2l}\sqrt{\frac{T}{\mu}}$

B. $\frac{1}{l}\sqrt{\frac{T}{\mu}}$

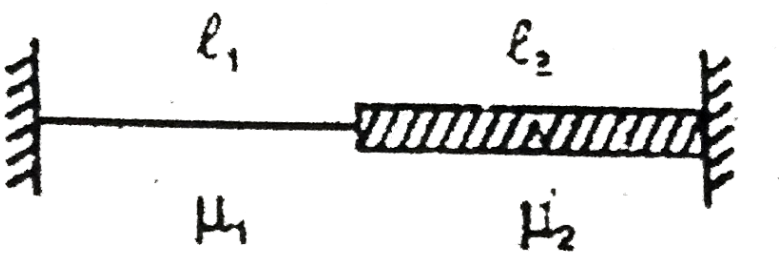
C. $\frac{4}{l}\sqrt{\frac{T}{\mu}}$

D. $\frac{2}{l}\sqrt{\frac{T}{\mu}}$

Answer: A

Watch Video Solution

16. A composite wire is made by joining two uniform wires. If $l_1 = l_2 = l$ and $\mu_1 = \frac{\mu_2}{9} = \mu$. Tension in the strings is T , μ is mass per unit length. Then lowest frequency such that the junction is an antinode.



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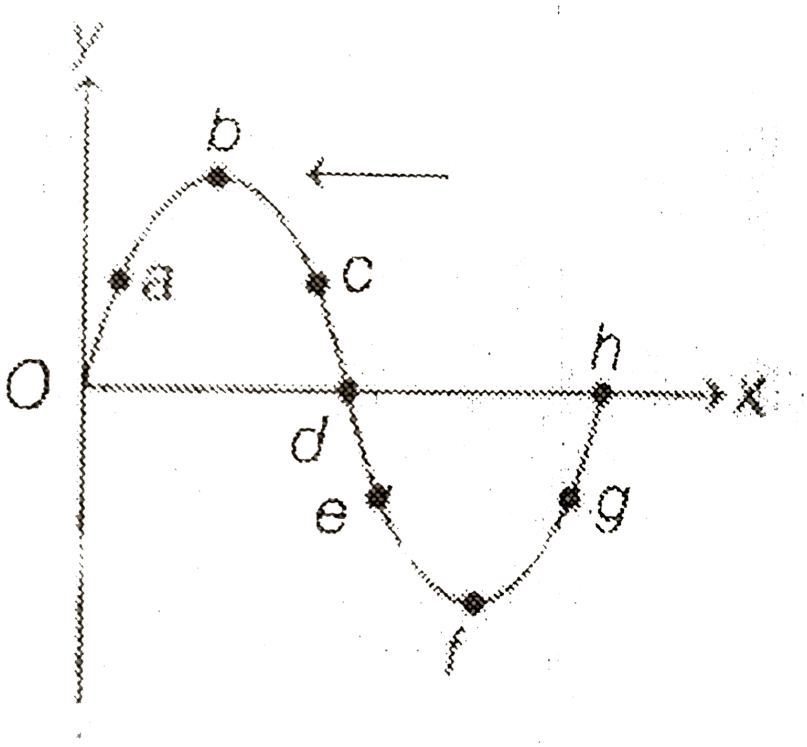
17. The figure represents the instantaneous picture of a transverse harmonic wave travelling along the negative x-axis . Choose the correct alternative(s) realted to the movement of the nine points shown in the figure [more than one option may be correct]



The points moving upward is /are

A. a

B. c

C. f

D. g

Answer: A::D

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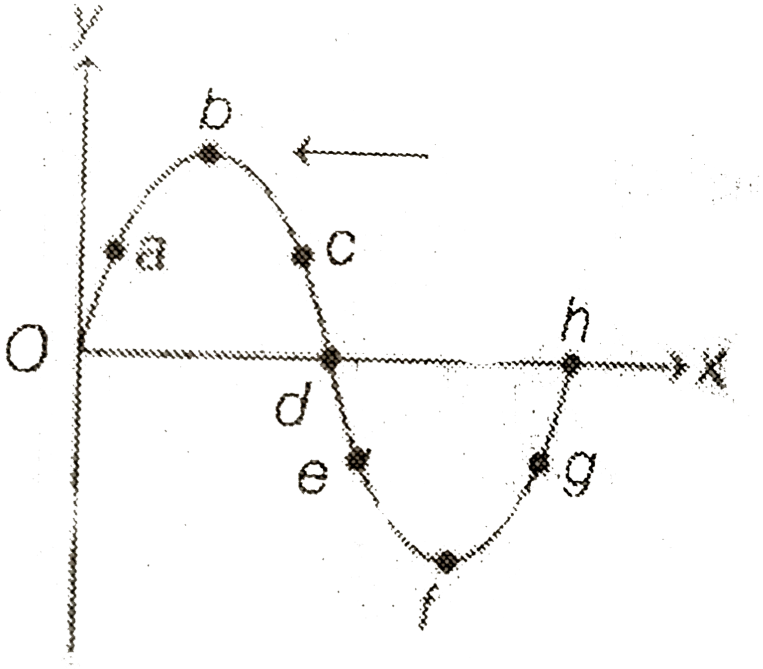
18. The figure represents the instantaneous picture of a transverse harmonic wave travelling along the negative x-axis . Choose the correct alternative(s) realted to the movement of the nine points shown in the figure [more than one option may be correct]



The points moving downward is /are

A. o

B. b

C. d

D. h

Answer: C

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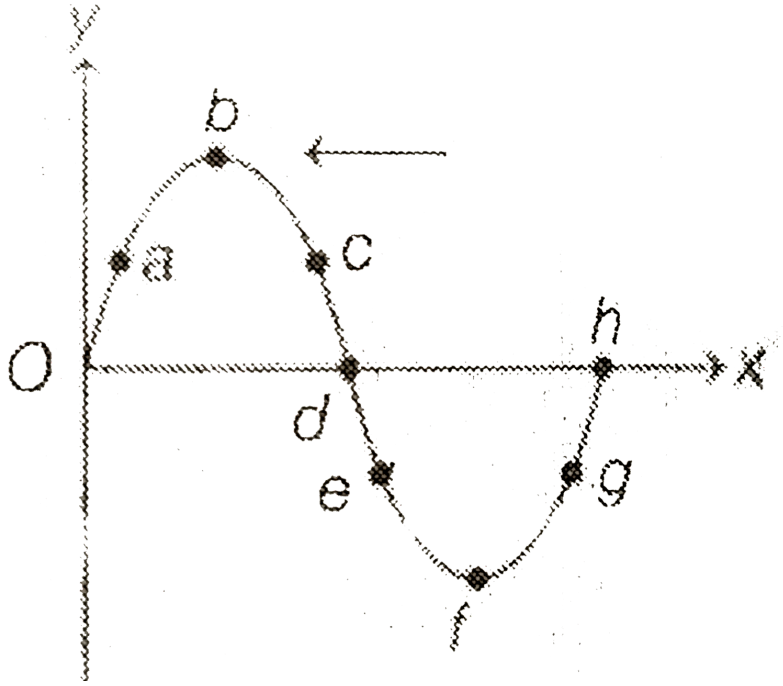
19. The figure represents the instantaneous picture of a transverse harmonic wave travelling along the negative x-axis . Choose the correct alternative(s) realted to the movement of the nine points shown in the figure [more than one option may be correct]



The stationary point is /are

A. o

B. b

C. d

D. h

Answer: B

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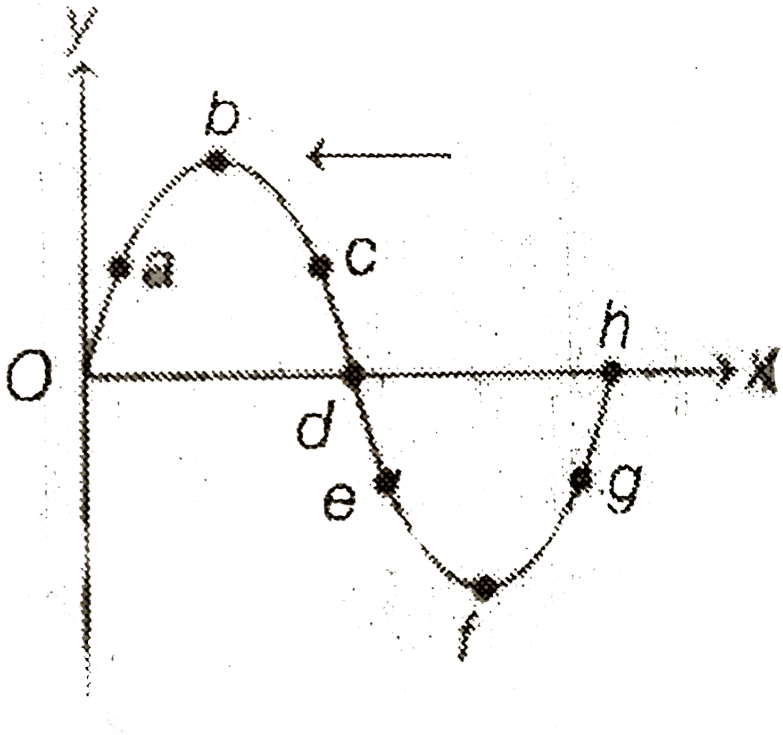
20. The figure represents the instantaneous picture of a transverse harmonic wave travelling along the negative x-axis . Choose the correct alternative(s) realted to the movement of the nine points shown in the figure [more than one option may be correct]



The point moving with maximum with speed is /are

A. b

B. c

C. d

D. h

Answer: C::D

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Matrix Matching

1. A sound source has frequency f. Source and observer both have same speed.For the apparent frequency observed by observer match the following.

Table-1	Table-2
(A) Observer is approaching the source but source is receding from the observer	(P) more than *f*
(B) Observer and source both approaching towards each other	(Q) less than *f*
(C) Observer and source both receding from each other	(R) equal to *f*
(D) Source is approaching but observer is receding	

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2. In the equation ,y =A sin $2\pi(ax + bt + \pi/4)$match the following.

Table-1	Table-2
(A) Frequency of wave	(P) a
(B) Wavelength of wave	(Q) b
(C) Phase difference between two points $\frac{1}{4a}$ distance apart	(R) π
(D) Phase difference of a point after a time interval of $\frac{1}{8b}$	(S) $\pi/2$
	(T) None

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3. A wave is transmitted from denser to a rarer medium. Then match the following.

Table-1	Table-2
(A) Frequency of wave	(P) will increase
(B) Speed of wave	(Q) will decrease
(C) Wavelength of wave	(R) will remain unchanged
(D) Amplitude of wave	(S) may increase or decrease

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4. For a closed organ pipe, match the following .

Table-1		Table-2	
(A)	Third overtone frequency is x times the fundamental frequency. Here, x is equal to	(P)	3
(B)	Number of nodes in second overtone	(Q)	4
(C)	Number of antinodes in second overtone	(R)	5
		(S)	None

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5. A string is suspended from the ceiling. A wave train is produced at the bottom at regular interval. As the wave moves upwards

Table-1		Table-2	
(A)	mass per unit length of the string	(P)	increases
(B)	tension in the string	(Q)	decreases
(C)	wave speed	(R)	remains same
(D)	wavelength		

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6. From a single source, two wave trains are sent in two different string. The two wave equations are ((area of cross-section and tension of both string are same y_1 = A sin $(w_1t - k_1x)$ and $y_2 = 2A\sin(w_1t - k_2z)$ Suppose u = energy density , P = power trasmitted and I = intensity of the wave, then match the following.

Table-1	Table-2
(A) u_1/u_2 is equal to	(P) 1/8
(B) P_1/P_2 is equal to	(Q) 1/16
(C) I_1/I_2 is equal to	(R) 1/4

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7. Regarding speed of sound ingas, match the following .

Table-1	Table-2
(A) Temperature of gas is made 4 times and pressure 2 times	(P) speed becomes $2\sqrt{2}$ times
(B) Only pressure is made 4 times without change in temperature	(Q) speed becomes 2 times
(C) Only temperature is changed to 4 times	(R) speed remain unchanged
(D) Molecular mass of the gas is made 4 times	(S) speed remain half

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8. Fundamental frequency of a closed of a pipe is 100 and that of an open pipe is 200 Hz. Match following $(V_s = 330m/s)$

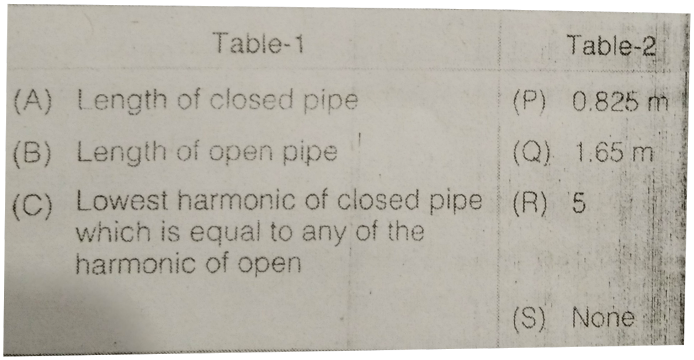

	Table-1		Table-2
(A)	Length of closed pipe	(P)	0.825 m
(B)	Length of open pipe	(Q)	1.65 m
(C)	Lowest harmonic of closed pipe which is equal to any of the harmonic of open	(R)	5
		(S)	None

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9. Speed of longitudinal wave $v \propto \sqrt{E}$. Here, E is the modulus of elesticity. Match the following.

Table-1	Table-2
(A) In case of solid E is	(P) Bulk modulus of elasticity
(B) In case of liquid E is	(Q) Shear modulus of elasticity
(C) In case of gas E is	(R) Young's modulus of elasticity
	(S) None

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10. A string fixed at both ends first oscillates in its fundamental mode then in second harmonic mode.Then match the following.

Table-1	Table-2
(A) Frequency	(P) in second case is more
(B) Wavelength	(Q) in second case is less
(C) Energy of string	(R) in second case is same

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11. Following is given the equation of a travelling wave (all is SI unit)

$y = (0.02) \sin 2\pi(10t - 5x)$

Match of following.

Table-1		Table-2	
(A)	Speed of wave	(P)	10
(B)	Angular frequency of wave	(Q)	0.4π
(C)	Wavelength of wave	(R)	2
(D)	Maximum particle speed	(S)	0.2

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12. Following is given the eqution of a stationary wave (all in SI units)

y = (0.06)sin $(2\pi x)\cos(5\pi t)$

Match of following.

Table-1		Table-2	
(A)	Amplitude of constituent wave	(P)	0.06
(B)	Position of node at x =.....m	(Q)	0.5
(C)	Position of antinode at x=.....m	(R)	0.25
(D)	Amplitude at $x = \frac{3}{4}$ m	(S)	0.03

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13. Match the following.

Table-1		Table-2	
(A)	In refraction	(P)	Speed of wave does not change
(B)	In reflection	(Q)	Wavelength is decreased
(C)	In refraction from rarer to denser medium	(R)	Frequency does not change
(D)	In reflection from a denser medium	(S)	Phase change of π takes place

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14. In case of mechanical wave a particle oscillates and during oscillation its kinetic energy and potential energy changes.

Table-1		Table-2	
(A)	When particles of travelling wave is passing through mean position	(P)	Kinetic energy is maximum
(B)	When particles of travelling wave is at extreme position	(Q)	Potential energy is maximum
(C)	When particles between node and antinode in standing wave is passing through mean position	(R)	Kinetic energy is minimum
(D)	When particles between node and antinode in standing wave is at extreme position	(S)	Potential energy is minimum

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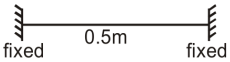
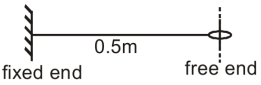
15. In each of the four situations of column-I , a stretched string or an organ pipe is given along with the required data. In case of strings the tension in string is T=102.4 N and the mass per unit length of string is 1g/m. Speed of sound in air is 320 m/s. Neglect end corrections.The frequencies of resonance are given in column-II.Match each situation in column-I with the possible resonance frequencies given in Column-II.

Column-I	Column-II
(p) String fixed at both ends 	(1) 320 Hz
(q) String fixed at one end and free at other end 	(2) 480 Hz
(r) Open organ pipe 	(3) 640 Hz
(s) Closed organ pipe 	(4) 800 Hz

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16. A source of sound of frequency 1000 Hzmoves to the right with a speed of 50 m/s relative to the ground. To its right is a reflecting surface moving to the left as shown in figure. Speed of the sound in air is 330 m/s.

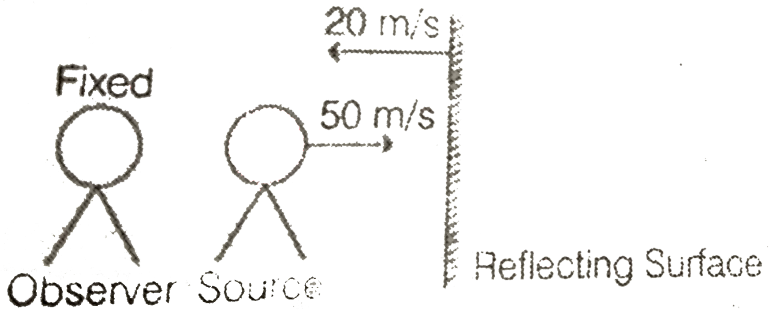

Table-1	Table-2
(A) Number of waves arriving per second at the reflecting surface	(P) 248
(B) Speed of reflected wave (in m/s)	(Q) 462
(C) Wavelength of reflected wave (in mm)	(R) 1250
(D) Difference in the two frequencies (in Hz) received by the stationary observer	(S) 330

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Integer Type Question

1. Two wires of same material of radii 2r and r are welded together end to end The combination is used as a sonometer wire and is kept under tension T. The welded point lies midway between the bridges. What wil be the ratio of the number of loops formed in the wires, such that the joint is node when the stationary waves are set up in the wire?

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2. An ambhulance blowing a siren of frequency 700Hz is travelling slowly towards vertical reflectoing wall with a speed 2m/s. The speed of sound is 350m/s. How many beats ar heard per sec to the driver of het ambluance?

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3. Four souces of sound each of sound level 10dB are sounded together in phase, the resultant intensity level will be (110/n) dB. Find value of n

$(\log_{10} 2 = 0.3)$.

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4. A person speaking normally produces a sound intensity of 40dB at a distance of 1m. If the threshold intensity for reasonable audibility is 20dB, the maximum distance at which a person can be heard clearly is (2x) meter . Find the value of x.

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5. A strain of sound waves is propagated along an organ pipe and gets reflected from an open end . If the displacement amplitude of the waves (incident and reflected) are $0.002cm$, the frequency is $1000Hz$ and wavelength is $40cm$. Then , the displacement amplitude of vibration at a point at distance $10cm$ from the open end , inside the pipe is

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6. A standing wave $y = A\sin\left(\frac{20\pi x}{3}\right)\cos(1000\pi t)$ is set up in a taut string where x and y are in meter. The distance between two successive points oscillating with the amplitude $\frac{A}{2}$ can be equal to (x)cm. Find the value of x.

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7. A string of length 0.4 m and mass 10^{-2} kg is tightly clamped at its ends. The tension in the string is 1. 6 N. identical wave pulses are produced at one end at equal intervals of time Δt. The value of Δt which allows construction interference between successive pulses is

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8. Two speakeer connected to the same source of fixed frequency are placed 2m apart in a box. A sensitive microphone placed at a distance of 4m from the midpoint alon the perpendicular bisector shown maximum response. The box is slowly rotated till the speaker are in line with the

microphone, The distance between the midpoint of the speakers and the microphone remains unchanged. Exactly 5 maximum responses (inculuding the initial and last one) and observed in the microphone in doing this. The wavelength of the sound wave is (o.x) meter. Find the value of x.

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9. One end of a string of length L is tied to the ceiling of a lift accelerating upwards with an acceleration 2g. The other end o the string is free. The linear mass density of the string varies linearly from 0 to λ from bottom to top. The acceleration of a wave pulled through out the string is $\frac{pg}{4}$. Find p.

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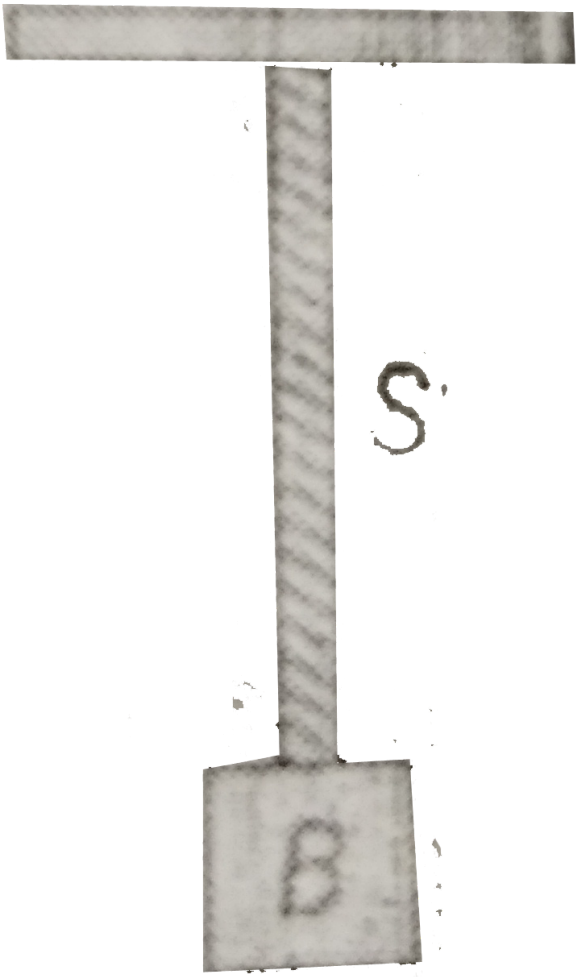
10. A 400 gm block B is suspended with uniform string S of mass 100gm and length 20cm as shown. Variation of tension T with distance x from the end block is hanging is T=4+4x, where T is (mN) anad x in meters. Find

the value of K ($\in N/m$). $\left(g = 10m/s^2\right.$



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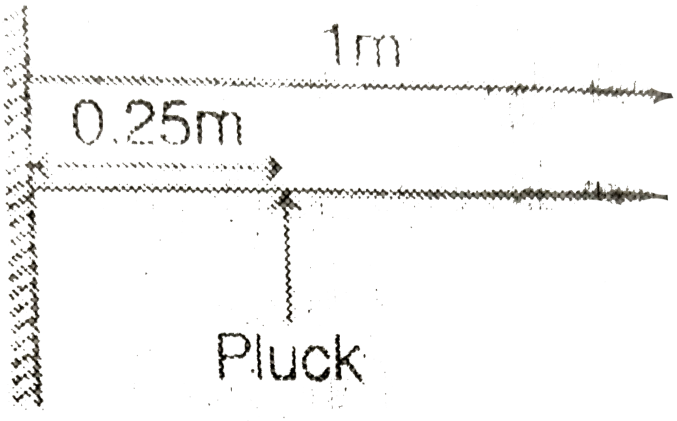
11. A steel wire is rigidly fixed at both ends. Its length mass and cross-sectionl area are 1m, 0.1kg and $10^{-8}m^2$ respectively. Tension in the wire is produced by lowering the temperature by $20^{\circ}C$. If the transerverse waves are some up by plucking the wire at 0.25m from one end and assuming that the wire viberates with minimum number of loops possble for such a case. The frequency of viberation (in Hz) is found to be. 1.11. Find the value of K. Given $\alpha = 1.21 \times 10^{-5}.^{\circ} C^{-1}. Y - 2 \times 10^{11} N/m^2$



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