PHYSICS

BOOKS - AAKASH SERIES

WAVE MOTION

LECTURE SHEET (EXERCISE-I (LEVEL-I(MAIN)STRAIGHT OBJECTIVE TYPE QUESTIONS))

1. Which of the following expressions is that of a simpleharmonic progressive wave ?

A. y = A sin wt

B. y = A sin wt cos kx

C. y = A sin (wt-kx)

D. y = A cos kx

Answer: C

Watch Video Solution

2. The displacement y of a particle in a medium can be expressed as $y = -6\sin\left(100t + 20x + \frac{\pi}{4}\right)m$ where t is in seconds and x in metres. The speed of the wave is:

A. $2000ms^{-1}$

B. $5ms^{-1}$

C. $20ms^{-1}$

D. $5\pi ms^{-1}$

Answer: B

Watch Video Solution

3. The equation of a transverse wave travelling on a rope given by $y = 10\sin\pi(0.01x - 2.00t)$ whrer y and x are in cm and t in second .This maximum traverse speed of a particle in the rope is about

A. 62.8 cm/s

B. 75 cm/s

C. 100 cm/ s

D. 121 cm/s

Answer: A

Watch Video Solution

4. A progressive wave moves with a velocity of 36m/ s in a medium with a frequency of 200Hz. The phase difference between two particles seperated by a distance of 1 cm is

A. 40°

B. $20 rad$

C. $\frac{\pi}{9} rad$

D. $\frac{\pi}{9}$ degree

Answer: C

Watch Video Solution

LECTURE SHEET (EXERCISE-I (LEVEL-II(ADVANCED)STRAIGHT OBJECTIVE TYPE QUESTIONS))

1. The displacement of the particle at x = 0 of a stretched string carrying a wave in the positive x-direction is given by $f(t) = A\sin\left(\frac{t}{T}\right)$. The wave speed is v. Write the wave equation.

A. $f(x, t) = A\sin\left(\frac{t}{T} - \frac{x}{V}\right)$

B. $f(x, t) = A\sin\left(\frac{t}{T} + \frac{x}{VT}\right)$

C. $f(x, t) = A\sin\left(t + \frac{x}{VT}\right)$

D. $f(x, t) = A\sin\left(\frac{t}{T} - \frac{x}{VT}\right)$

Answer: D

Watch Video Solution

2. The coordinates of a particle moving in a plane are given by x (t) = a cos (pt) and y (t) = b sin (pt), where a, b ($<$ a), and p are positive constants of appropriate dimensions. Then:

A. x = 0, 20 cm and 40 cm

B. x = 20 m, 40 cm and 60 cm

C. x = 10 m, 20 cm and 30 cm

D. x = 4cm, 10 cm and 15 cm

Answer: A

Watch Video Solution

3. A motion is described by `y = 3e^x.e^(-3t) where y,x arc in metrd and t is in seconds.

A. This represents equation of progressive wave propagating along -x direction with $3ms^{-1}$

B. This represents equation of progressive wave propagating along +x direction with $3ms^{-1}$

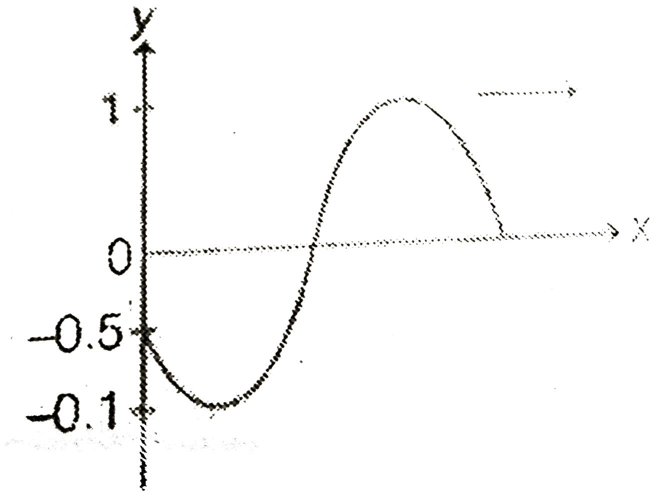
C. This does not represent a progressive wave equation.

D. Date is insufficient to arrive at any conclusion of this sort

Answer: C

Watch Video Solution

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



A. $1\sin\left(kx - \omega t + \frac{\pi}{6}\right)$

B. $1\sin\left(kx - \omega t - \frac{\pi}{6}\right)$

C. $1\sin\left(\omega t - kx + \frac{\pi}{6}\right)$

D. $1\sin\left(\omega t - kx - \frac{\pi}{6}\right)$

Answer: B

Watch Video Solution

5. A pulse is propagating on a long stretched string along its length taken as positive x-axis. Shape of the string at t = 0 is given by $y = \sqrt{a^2 - x^2}$ when $|x| \le a = 0$ when $|x| \ge a$. What is the general equation of pulse after some time 't' , if it is travelling along positive x-direction with speed V?

A. $y(x, t) = \sqrt{a^2 - (x + Vt)^2}$ when $|x + Vt| \le a = x + Vt$ when $|x + Vt| \ge a$

B. $y(x, t) = \sqrt{a^2 + (x - Vt)^2}$ when $|x - Vt| \le a = a$ when $|x + Vt| \ge 0$

C. $y(x, t) = \sqrt{a^2 - (x - Vt)^2}$ when $|x - Vt| \le a = 0$ when $|x - Vt| \ge a$

D. $y(x, t) = \sqrt{a^2 + (x + Vt)^2}$ when $|x + Vt| \le a = a$ when $(x + Vt) \ge a$

Answer: C

Watch Video Solution

LECTURE SHEET (EXERCISE-I (LEVEL-II(ADVANCED)MORE THAN ONE CORRECT ANSWER TYPE QUESTIONS))

1. 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 $t = 2T$?

A. The speed of the wave is a/T.

B. The wave is travelling along negative x-axis

C. The maximum of the pulse located at t = T is x = -a

D. The maximum of the pulse located at t = 2T is x = -2a

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

Watch Video Solution

2. A wave $y = A\cos(\omega t - kx)$ passes through a medium. If V is the particle velocity and a is the particle acceleration then,

A. y,V and 'a' all are in the same phase

B. y lags behind V by a phase angle of $\frac{\pi}{2}$

C. 'a' leads y by a phase angle of π

D. 'V' leads a by a phase angle of $\frac{3\pi}{2}$

Answer: B::C::D

Watch Video Solution

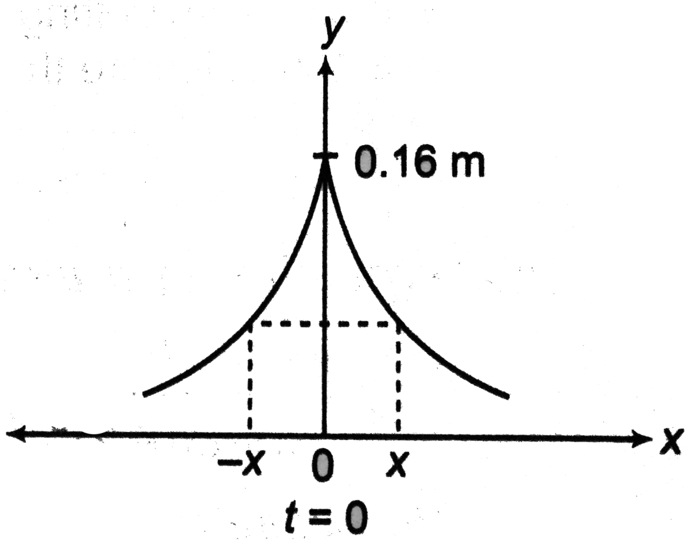
3. $y(x, t) = \dfrac{0.8}{\left[(4x + 5t)^2 + 5\right]}$ represents a moving pulse where x and y are in metre and t in second. Then,choose the correct alternative(s):

(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



A. pulse is moving in +ve x direction

B. in 2s it will travel a distance of 2.5m

C. its maximum displacement is 0.16m

D. it is a symmetric pulse

Answer: B::C::D

Watch Video Solution

4. A plane progessive wave of frequency $25Hz$, amplitude $2.5 \times 10^{-5}m$ and initial phase zero propagates along the negative x-direction with a velocity of $300m/s$. At any instant, the phase difference between the oscillations at two points $6m$ apart the line of propagation is _____ .

A. A = 0

B. $\phi = 0$

C. $A = 2.5 \times 10^{-5}m$

D. $\phi = \pi$

Answer: A::D

Watch Video Solution

LECTURE SHEET (EXERCISE-I (LEVEL-II(ADVANCED)LINKED COMPREHENSION TYPE QUESTIONS))

1. A travelling wave on a long stretched string along the positIve x-axis is given by $y = 5mme\left(\frac{T}{5s} - \frac{x}{5cm}\right)^2$. Using this equation answer the following questions.

The velocity of the wave is

A. 1m/s

B. 5m/s

C. 1cm/s

D. 1mm/s

Answer: C

Watch Video Solution

2. A travelling wave on a long stretched string along the positIve x-axis is given by $y = 5mme\left(\frac{t}{5s} - \frac{x}{5cm}\right)^2$. Using this equation answer the following questions.

At t = 0, x = 0, the displacement of the wave is

A. 0

B. ∞

C. 5mm

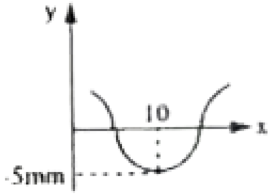
D. 10mm

Answer: C

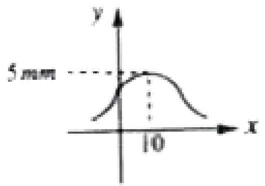
Watch Video Solution

3. A travelling wave on a long stretched string along the positIve x-axis is given by $y = 5mme\left(\frac{T}{5s} - \frac{x}{5cm}\right)^2$. Using this equation answer the following questions.

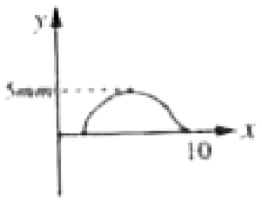
The plot of y and x at t = 10 s is best indicated by



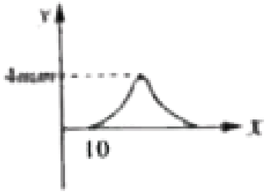
A.



B.



C.



D.

Answer: B

Watch Video Solution

LECTURE SHEET (EXERCISE-I (LEVEL-II(ADVANCED)MATRIX MATCHING TYPE QUESTIONS))

1. Symbols have their usual meanings. Match the Column-I with Column-II:

Column-I

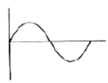
A) String slope versus time t at $x = 0$ for $y = A\sin(kx + \omega x)$

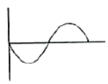
B) Instantaneous velocity of particle versus time t at $x = 0$ for $y = A\sin(kx - \omega x)$

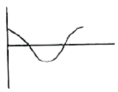
C) Displacement of particle versus time t at $x = 0$ for $s = s_0 \sin(\omega t - kx)$

D) Displacement of particle versus time t at $x = 0$ for $p = p_0 \cos(kx - \omega t)$ where p represents pressure variation.

Column-II

p) 

q) 

r) 

s) 

Watch Video Solution

LECTURE SHEET (EXERCISE-II (LEVEL-I(MAIN) STRAIGHT OBJECTIVE TYPE QUESTIONS))

1. Two strings A and B, made of the same material, have equal lengths. The cross sectional area of A is half that of B while the tension on A is twice that on B. The ratio of the velocities of transverse waves in A and B is

A. $\sqrt{2}:1$

B. $1:\sqrt{2}$

C. $2:1$

D. $1:2$

Answer: C

Watch Video Solution

2. The density of the stretched string is changed by 2% without change in tension and radius. The change in transverse wave velocity.

A. 2% increase

B. 1% increase

C. 1% increase or decrease

D. 4% change

Answer: C

Watch Video Solution

3. 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. $v/\sqrt{2}$

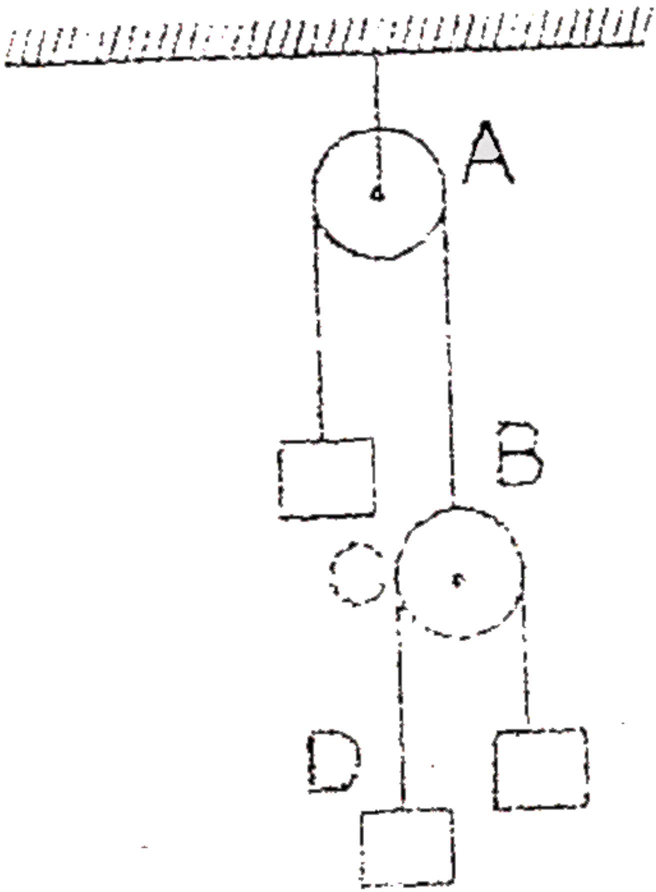
C. $\sqrt{2}v$

D. $4v$

Answer: C

Watch Video Solution

4. Both the strings, shown in figure, are made of same material and have same cross-section. The pulleys are light. The wave speed of transverse wave in the string AB is v_1 and in CD it is v_2, the v_1/v_2 is



A. 1

B. 2

C. $\sqrt{2}$

D. $1/\sqrt{2}$

Answer: D

Watch Video Solution

5. A wire of length L, is hanging vertically from a rigid support. If a transverse wave pulse is generated at the free end of wire then which of the following statement is wrong

A. Velocity at bottom end is zero

B. Velocity at top end is $\sqrt{gL}$

C. Time taken to reach the top end is $2\sqrt{\frac{L}{g}}$

D. Acceleration of wave is g

Answer: D

Watch Video Solution

6. The mass of a 10 m long wire is 100 grams. If a tension of 100 N is applied, calculate the time taken by a transverse wave to travel from one end to the other end of the wire.

A. 0.5s

B. 0.1s

C. 2s

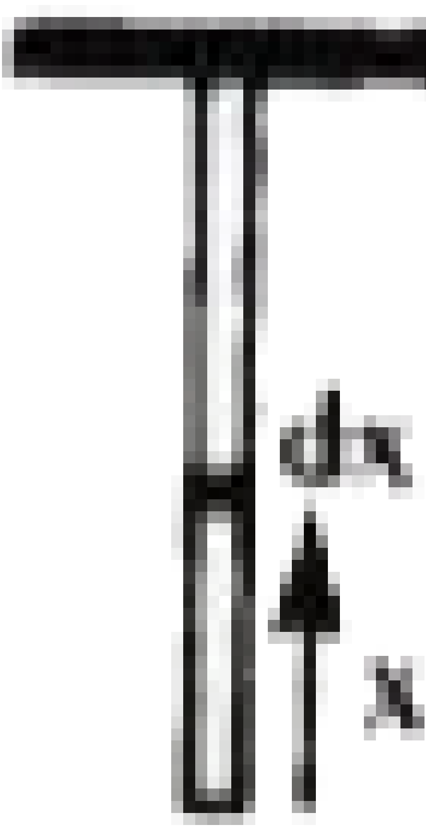
D. 2.5s

Answer: B

Watch Video Solution

LECTURE SHEET (EXERCISE-II (LEVEL-II(ADVANCED) STRAIGHT OBJECTIVE TYPE QUESTIONS))

1. A wire of variable mass per unit length $\mu = \mu_0 x$, is hanging from the ceiling as shown in figure. The length of wire is l_0 . A small transverse disturbance is produced at its lower end. Find the time after which the disturbance will reach to the other ends.



A. $\sqrt{\dfrac{6l_0}{g}}$

B. $\sqrt{\frac{8l_0}{g}}$

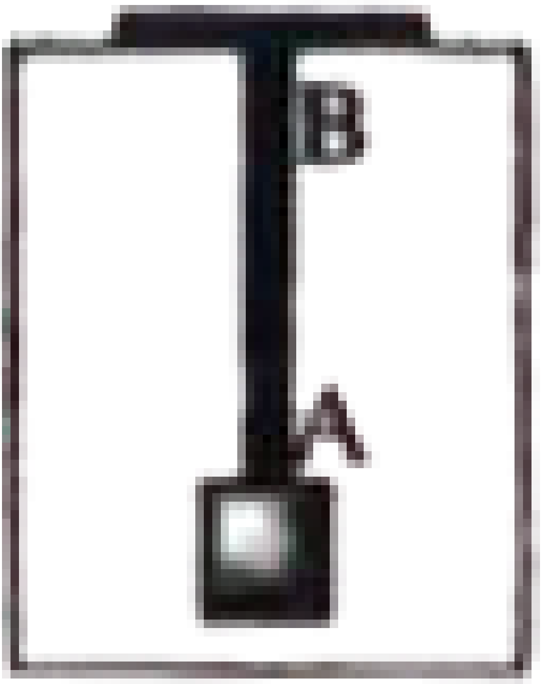
C. $\sqrt{\frac{9l_0}{g}}$

D. $\sqrt{\frac{10l_0}{g}}$

Answer: B

Watch Video Solution

2. A block of mass M is attached with a string of mass m and length l as shown in figure. The whole system is placed on a planet whose mass and radius is three times the mass and radius of earth. Find the ratio of maximum and minimum velocity of wave pulse. Assume the acceleration due to gravity on the earth to be g.



A. $\frac{V_{max}}{V_{min}} = \sqrt{1 + \frac{m}{M}}$

B. $\frac{V_{max}}{V_{min}} = \sqrt{1 + \frac{M}{m}}$

C. $\frac{V_{max}}{V_{min}} = \sqrt{\frac{M - m}{m}}$

D. $\frac{V_{max}}{V_{min}} = \sqrt{\frac{M}{M - m}}$

Answer: A

Watch Video Solution

3. A wave pulse starts propagating in the x direction along a non uniform wire of length 10m with mass per unit length is given by $\mu = \mu_0 + ax$ and under a tension of 100N. The time taken by a pulse to travel from the lighter end to heavier end $\left(\mu_0 = 10^{-2} kg/m \text{ and } a = 9 \times 10^{-3} kg/m^2\right)$ is

A. 22.27 sec

B. 2.27 sec

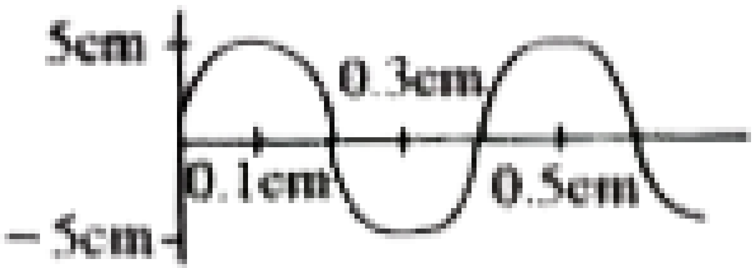
C. 0.227 sec

D. 0.0227 sec

Answer: C

Watch Video Solution

4. Figure shows the shape of part of a long string in which transverse waves are produced by attaching one end of the string to tuning fork of frequency 250 Hz. What is the velocity of the waves?



A. $1.0\ ms^{-1}$

B. $1.5 ms^{-1}$

C. $2.0 ms^{-1}$

D. $2.5 ms^{-1}$

Answer: A

Watch Video Solution

5. A wire of $9.8 \times 10^{-3} k\frac{g}{m}$ passes over a frictionless light pulley fixed on the top of a frictionless inclined plane which makes an angle of 30° with the horizontal. Masses m and M are tied at the two ends of wire such that m rests on the plane and M hangs freely vertically downwards. the entire system is in equilibrium and a transverse wave propagates along the wire with a velocities of $100 m/s$.

A. M = 5kg

B. $\frac{m}{M} = \frac{1}{4}$

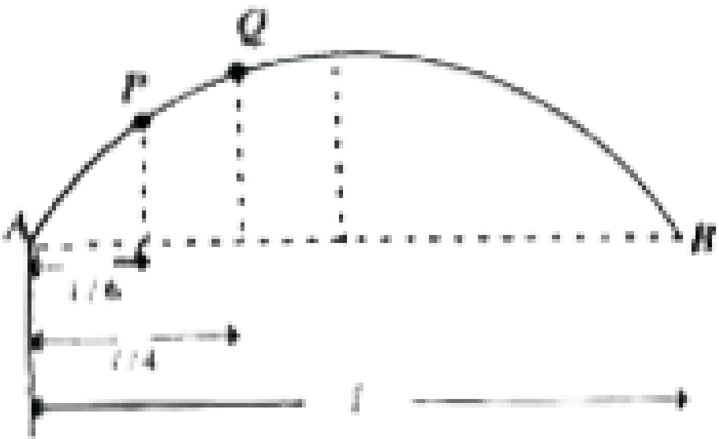
C. $m = 20kg$

D. $\frac{m}{M} = 4$

Answer: C

Watch Video Solution

6. A string vibrates with one loop between the fixed points A and B. The ratio of magnitudes of maximum velocities of P and Q is [The shape of string when P and Q having zero speeds as shown in the figure].



A. $2:3$

B. $1:\sqrt{2}$

C. $1:\sqrt{3}$

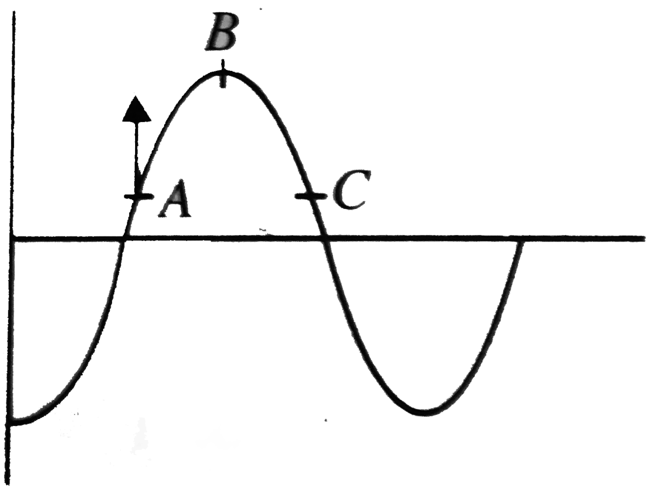
D. none

Answer: B

Watch Video Solution

LECTURE SHEET (EXERCISE-II (LEVEL-II(ADVANCED) MORE THAN ONE CORRECT ANSWER TYPE QUESTIONS))

1. A wave is travelling along a string. At an instant shape of the string is as shown in the enclosed figure. At this instant, point A is moving upwards. Which of the following statements are correct?



A. The wave is travelling to the right

B. Displacement amplitude of the wave is equal to the displacement of B at this instant

C. At this instant velocity of C is also directed upwards

D. Phase difference between A and C may be equal to $\pi/2$ if $x = \lambda/4$

Answer: B::D

Watch Video Solution

2. A transverse waves is travelling in a string. Study following statement.

(i) Equation of the wave is equal to the shape of the string at an instant t. (ii) Equation of thhe wave is general equation for displacement of a particle of the string (iii) Equation of the wave must be sinusoidal equation (iv) Equation of the wave is an equation for displacement of the particle at one end only.correct statement are

A. is the general equation for displacement of a particle of the string at any instant 't'.

B. is the equation of the shape of the string at any instant t.

C. must have sinusoidal form

D. is an equation of displacement for the particle at any one end at a particular time 't'.

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

Watch Video Solution

3. The energy per unit area associated with a progressive sound wave will be doubled if

A. the amplitude of the wave is doubled

B. the amplitude of the wave is increased by 50%

C. the amplitude of the wave is increased by 41%

D. the frequency of the wave is increased by 41%

Answer: C::D

Watch Video Solution

4. A uniform rope of mass M length L hangs vertically from the ceiling, with lower end free. A distbance on the rope trvelling upwards starting from the lower end has a velocity v. At a point P at distance x from the lower end.

A. Tension at point P is mg

B. $v = \sqrt{xg}$

C. $v = \sqrt{2xg}$

D. Tenstion at point P is $\left(\frac{M}{L}\right)xg$

Answer: B::D

Watch Video Solution

LECTURE SHEET (EXERCISE-II (LEVEL-II(ADVANCED) INTEGER TYPE QUESTIONS))

1. A loop of a string of mass length μ and redius R is rotated about an axis passing through centre perpendicular to the plane with an angular velocity ω.A small disturbance is created in the loop having the same sense of rotation. The linear speed of the disturbance observer is

Watch Video Solution

2. The diameter of a stretched string is increased 3%, keeping the other parameters constant then the velocity is x% decreases what is the value of x ?

Watch Video Solution

3. If the earth were to spin faster, acceleration due to gravity at the poles :

Watch Video Solution

LECTURE SHEET (EXERCISE-III (LEVEL-I(MAIN) STRAIGHT OBJECTIVE TYPE QUESTIONS))

1. The length of a string attached to two rigid supports is 40 cm. The maximum wavelength in cm of a stationary wave produced on it is :

A. 20cm

B. 80cm

C. 40cm

D. 120cm

Answer: B

Watch Video Solution

2. The length of a sonometer wire AB is 100 cm, where should the two bridges be placed from A to divide the wire in 3 segments whose fundamental frequencies are in the ratio of 1:2:6

A. 30 cm, 90 cm

B. 60cm, 90 cm

C. 40 cm, 80 cm

D. 20 cm, 30 cm

Answer: B

Watch Video Solution

3. When the tension in a string is increased by 44%. the frequency increased by 10Hz the frequency of the string is

A. 100 Hz

B. 200 Hz

C. 150 Hz

D. 50 Hz

Answer: D

Watch Video Solution

4. To increase the frequency by 20 %, the tension in the string vibrating on a sonometer has to be increased by

A. 0.44

B. 0.33

C. 0.22

D. 0.11

Answer: A

Watch Video Solution

5. The ends of a stretched wire of length L are fixed at x = 0 and x = L, In one experiment, the displacement of wire is $y_1 = A\sin(\pi x/L)\sin\omega t$ and energy is E_1 and in another experiment its displacement is $y_2 = A\sin(2\pi x/L)\sin 2\omega t$ and energy is E_2. Then

A. $E_2 = E_1$

B. $E_2 = 2E_1$

C. $E_2 = 4E_1$

D. $E_2 = 16E_1$

Answer: C

Watch Video Solution

6. Transverse waves are generated in two uniform wires A and B of the same material by attaching their free ends to a vibrating source of frequency 200 Hz. The Area of cross section of A is half that of B while tension on A is twice than on B. The ratio of wavelengths of the transverse waves in A and B is

A. $1 : \sqrt{2}$

B. $\sqrt{2} : 1$

C. $1:2$

D. $2:1$

Answer: D

Watch Video Solution

7. A somoneter wire resonates with a given tuning fork forming standing waves with five antindoes between the two bridges when a mass of 9 kg is suspended from the wire. Resonates with the same tuning fork forming three antindoes for the same postions of the bridges. the value of M is

A. 25kg

B. 5kg

C. 12.5kg

D. 1/25kg

Answer: A

Watch Video Solution

8. Two vibrating strings of the same material but lengths L and 2L have radii 2 r and r respectively. They are strectched under the same tension. Both the strings vibrate in their fundamental modes, the one of length L with frequency n_1 and the other with frequency n_2. The ratio n_1/n_2 is given by

2

4

8

1

A. 2

B. 4

C. 8

D. 1

Answer: D

Watch Video Solution

9. An object of specific gravity ρ is hung from a thin steel wire. The fundamental frequency for transverse standing waves in the wire is 300 Hz. The object is immersed in water, so that one half of its volume is submerged . The new fundamental frequency (in Hz) is

(a) $300\left(\frac{2\rho-1}{2\rho}\right)^{\frac{1}{2}}$

(b) $300\left(\frac{2\rho}{2\rho-1}\right)^{\frac{1}{2}}$

(c) $300\left(\frac{2\rho}{2\rho-1}\right)$

(d) $300\left(\frac{2\rho-1}{2\rho}\right)$

A. $300\left(\frac{2\rho-1}{2\rho}\right)^{1/2}$

B. $300\left(\frac{2\rho}{2\rho - 1}\right)^{1/2}$

C. $300\left(\frac{2\rho}{2\rho - 1}\right)$

D. $300\left(\frac{2\rho - 1}{2\rho}\right)$

Answer: A

Watch Video Solution

10. 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. $a\sin(kx + \omega t)$

B. $-a\cos(kx - \omega t)$

C. $-a\cos(kx - \omega t)$

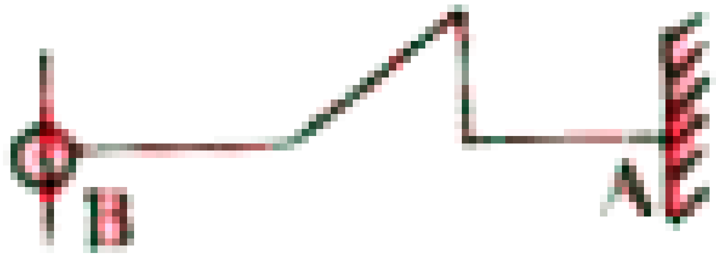
D. $-a\sin(kx - \omega t)$

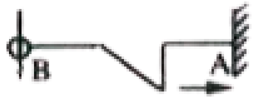
Answer: C

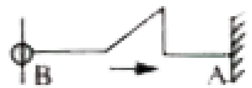
Watch Video Solution

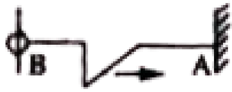
LECTURE SHEET (EXERCISE-III (LEVEL-II(ADVANCED) STRAIGHT OBJECTIVE TYPE QUESTIONS))

1. A pulse shown here is reflected from the rigid wall A and then from free end B. The shape of the string after these 2 reflection will be



A. 

B. 

C. 

D. 

Answer: A

Watch Video Solution

2. A long wire PQR is made by joining two wires PQ and QR of equal radii. PQ has a length 4.8m and mass 0.06 kg. QR has length 2.56 m and mass 0.2 kg. The wire PQR is under a tension of 80N. A sinusoidal wave pulse of amplitude 3.5 cm is sent along the wire PQ from the end P. No power is dissipated during the propagation of the wave pulse. Calculate:

(a) The time taken by the wave pulse to reach the other end R.

(b) The amplitude of the reflected and transmitted wave pulse after the incident wave pulse crosses the joint Q.

A. 0.14 s, 1.5 cm, 2 cm

B. 0.3 s, 1.2 cm, 2 cm

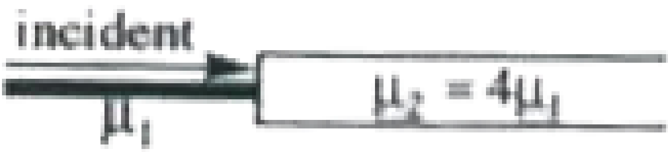
C. 0.4 s, 1.3 cm, 1 cm

D. 0.2 s, 1.1 cm, 3 cm

Answer: A

Watch Video Solution

3. String-1 is connected with string-2. The mass per unit length in string-1 is μ_1 and the mass per unit length in string-2 is $4\mu_1$. The tension in the strings is T. A travelling wave is coming from the left. What fraction of the energy in the incident wave goes into string-2 ?



A. $1/8$

B. $4/9$

C. $2/3$

D. $8/9$

Answer: B

Watch Video Solution

4. A steel wire of length 1 m, mass 0.1 kg and uniform cross-sectional area $10^{-6}m^2$ is rigidly fixed at both ends. The temperature of wire is lowered by 20°C. If transverse waves are set up by plucking the string in the middle, calculate the frequency (In S.I. units) of the fundamental mode of vibration. Young's modulus of steel $= 2 \times 10^{11}N/m^2$, coefficient of linear expansion of steel $= 1.21 \times 10^{-6}(degC)^{-1}$.

A. 21Hz

B. 31Hz

C. 11Hz

D. 1Hz

Answer: C

Watch Video Solution

5. A standing wave is maintained in a homogeneous string of cross-sectional area s and density ρ . It is formed by the superposition of two waves travelling in opposite directions given by the equation $y_1 = a\sin(\omega t - kx)$ and $y_2 = 2a\sin(omegt + kx)$. The total mechanical energy confined between the sections corresponding to the adjacent antinodes is

A. $\dfrac{3\pi s\rho\omega^2 a^2}{2k}$

B. $\dfrac{\pi s\rho\omega^2 a^2}{2k}$

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

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

Answer: C

Watch Video Solution

6. A somoneter wire resonates with a given tuning fork forming standing waves with five antindoes between the two bridges when a mass of 9 kg is suspended from the wire. Resonates with the same tuning fork forming three antindoes for the same postions of the bridges. the value of M is

A. 25kg

B. 5kg

C. 12.5kg

D. $\frac{1}{25}kg$

Answer: A

Watch Video Solution

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

A. A)$a\sin(kx + \omega t)$

B. B)-$a\cos(kx - \omega t)$

C. C)-$a\cos(kx + \omega t)$

D. D)-$a\sin(kx + \omega t)$

Answer: C

Watch Video Solution

LECTURE SHEET (EXERCISE-III (LEVEL-II(ADVANCED) MORE THAN ONE CORRECT ANSWER TYPE QUESTIONS))

1. Standing waves can be produced.

A. on a string clamped at both ends

B. on a string clamped at one end and free at the other

C. when incident wave gets reflected from a wall

D. when two identical waves with a phase difference of π are moving in the same direction

Answer: A::B::C

Watch Video Solution

2. The (x, y) co-ordinates of the corners of a square plate are $(0, 0)$, (L, L) and $(0, L)$. The edges of the plate are clamped and transverse standing waves are set up in it. If $u(x, y)$ denotes the displacement of the plate at the point (x, y) at some instant of time, the possible expression (s) for u is (are) $(a = positiveconstant)$

A. $a\cos(\pi x/2L)\cos(\pi x/2L)$

B. $a\sin(\pi x/L)\sin(\pi y/L)$

C. $a\sin(\pi y/L)\sin(2\pi y/L)$

D. $a\cos(2\pi x/L)\sin(\pi y/L)$

Answer: B::C::D

Watch Video Solution

3. The coordinates of a particle moving in a plane are given by x (t) = a cos (pt) and y (t) = b sin (pt), where a, b ($<$ a), and p are positive constants of appropriate dimensions. Then:

A. A node occurs at x = 0.15m

B. An antinode occurs at x = 0.3m

C. The speed of wave is $5ms^{-1}$

D. The wavelength of wave is 0.2m

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

Watch Video Solution

LECTURE SHEET (EXERCISE-III (LEVEL-II(ADVANCED) LINKED COMPREHENSION TYPE QUESTIONS))

1. The displacement of a medium in a sound wave is given by the equation $y_1 = A\cos(ax + bt)$ where A, a and b are positive constants. The wave is reflected by an obstacle situated at x=0. the intensity of the reflected wave is 0.64 times that of the incident wave.

(i) What are the wavelength and frequency of incident wave ? _______

(ii) Write the equation for the reflected wave. _______ (iii) In the resultant wave formed after reflection, find the maximum and minimum values of the particle speeds in the medium. __________ (iv) Express the resultant wave as a superposition of a standing wave and a traveling wave. What are the positions of the antinodes of the standing wave ? What is the direction propagation of traveling wave?_________

A. y=0.8A Cos(bt – ax)

B. y=0.4A Sin(bt - ax)

C. y=-0.8A Cos(bt -ax)

D. y=0.4A Sin(bt + ax)

Answer: C

Watch Video Solution

2. The displacement of a medium in a sound wave is given by the equation $y_1 = A\cos(ax + bt)$ where A, a and b are positive constants.

The wave is reflected by an obstacle situated at x=0. the intensity of the reflected wave is 0.64 times that of the incident wave.

(i) What are the wavelength and frequency of incident wave ? ________

(ii) Write the equation for the reflected wave. ________ (iii) In the resultant wave formed after reflection, find the maximum and minimum values of the particle speeds in the medium. __________ (iv) Express the resultant wave as a superposition of a standing wave and a traveling wave. What are the positions of the antinodes of the standing wave ? What is the direction propagation of traveling wave?_________

A. $V_{max} = 1.8Ab, V_{min} = 0Ab$

B. $V_{max} = 0.9Ab, V_{min} = 0.1Ab$

C. $V_{max} = 1.1Ab, V_{min} = 0.1Ab$

D. $V_{max} = 1Ab, V_{min} = 0.5Ab$

Answer: A

Watch Video Solution

3. Two wires 1 and 2 of the same cross sectional area $A = 10mm^2$ and the same length but made of different materials are welded together and their ends are rigidly clamped between two walls, as shown in figure. The respective young's moduli and coefficient of linear expansions are

$y_1 = 10^9 N/m^2, y_2 = 2 \times 10^9 N/m^2, \alpha_1 = 6 \times 10^{-4} {}^\circ C^{-1}, \alpha_2 = 3 \times 10^{-4} {}^\circ C^{-1}$

. if temperature of system reduced by $20\ {}^\circ$C then

Find the displacement of the joint

A. 80N

B. 10N

C. 120N

D. 140N

Answer: C

Watch Video Solution

4. Two wires 1 and 2 of the same cross sectional area $A = 10mm^2$ and the same length but made of different materials are welded together and their ends are rigidly clamped between two walls, as shown in figure. The respective young's moduli and coefficient of linear expansions are $y_1 = 10^9 N/m^2, y_2 = 2 \times 10^9 N/m^2, \alpha_1 = 6 \times 10^{-4} {}^\circ C^{-1}, \alpha_2 = 3 \times 10^{-4} {}^\circ C^{-1}$. if temperature of system reduced by $20 {}^\circ$C then

Find the displacement of the joint

A. 0

B. 10cm

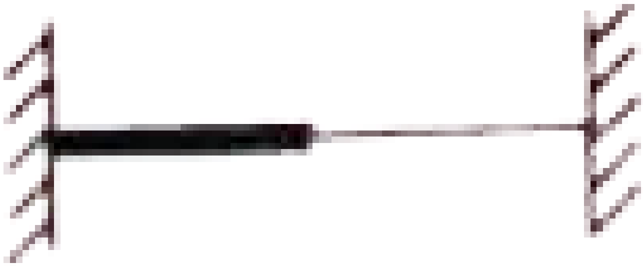
C. 5cm

D. 2cm

Answer: A

Watch Video Solution

5. Two wires 1 and 2 of the same cross sectional area $A = 10mm^2$ and the same length but made of different materials are welded together and their ends are rigidly clamped between two walls, as shown in figure. The respective young's moduli and coefficient of linear expansions are $y_1 = 10^9 N/m^2, y_2 = 2 \times 10^9 N/m^2, \alpha_1 = 6 \times 10^{-4} {}^\circ C^{-1}, \alpha_2 = 3 \times 10^{-4} {}^\circ C^{-1}$. if temperature of system reduced by $20 {}^\circ$C then



Find the displacement of the joint

A. 20Hz

B. 40Hz

C. 60Hz

D. 100Hz

Answer: B

Watch Video Solution

LECTURE SHEET (EXERCISE-III (LEVEL-II(ADVANCED) MATRIX MATCHING TYPE QUESTIONS))

1. Match the following

Column - I	Column - II
A) A vertical rod is hit vertically	p) pressure wave
B) A vertical rod is hit horizontally	q) transverse wave
C) A cylindrical tube having a gas is vibrated by a tuning fork	r) Displacement wave
D) Ripples on water surface	s) longitudinal wave

Watch Video Solution

2. A sinusoidal plane wave falls on a partially rigid boundary of reflection coefficient 0.36. Consider the location of the boundary at x = 0. Let the equation of incident wave be $y_1 = a\sin(\omega t - kx)$. then

Column - I	Column - II
A) Ratio of intensities of reflected wave and of transmitted wave is :	p) 9 : 16
B) Ratio of amplitude of reflected wave and of transmitted wave is :	q) $0.6a\sin(\omega t + kx + \pi)$
C) Equation of reflected wave is :	r) Zero
D) Phase difference between the incident wave and transmitted wave at x = 0 is :	s) 3 : 4

Watch Video Solution

LECTURE SHEET (EXERCISE-III (LEVEL-II(ADVANCED) INTEGER TYPE QUESTIONS))

1. The displacement of a particle in a periodic motion is given by $y = 4\cos^2(t/2)\sin(1000t)$. This displacement may be considered as the result superposition of n independent harmonic oscillations. Here , n is

Watch Video Solution

2. A point source of power 50W is producing sound waves of frequency 1875 Hz. The velocity of sound is 330 m/s, atmospheric pressure is 1.0×10 5 Nm −2 , density of air is 1.0 kgm −3 . Then pressure amplitude at r= 330 m from the point source is (usingπ=22/7):

Watch Video Solution

LECTURE SHEET (EXERCISE-IV (LEVEL-I(MAIN) STRAIGHT OBJECTIVE TYPE QUESTIONS))

1. The temperature at which the speed of sound in air becomes double of its value at $27^{\circ}C$ is

A. 273 K

B. 546 K

C. 1092 K

D. 0k

Answer: C

Watch Video Solution

2. The velocities of sound at the same temperature in two monoatomic gases of densities ρ_1 and ρ_2 are v_1 and v_2 respectively .

If $\rho_1/\rho_2 = 4$, then value of v_1/v_2 is

A. $1:2$

B. $4:1$

C. $2:1$

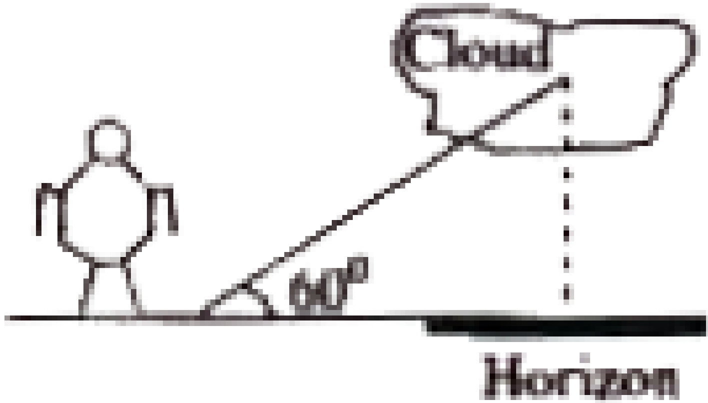
D. $1:4$

Answer: C

Watch Video Solution

3. The elevation of a cloud is 60° above the horizon. A thunder is heard 8s after the observation of lighting. The speed of sound is 330

ms^{-1} The vertical height of cloud form ground is



A. 2826 m

B. 2682 m

C. 2286 m

D. 2068 m

Answer: C

Watch Video Solution

4. the minimum distance between the reflecting surface and source for listening the eco of sound is (take speed of sound $340\frac{m}{s}$)

A. 16.5 m

B. 17m

C. 18m

D. 16m

Answer: B

Watch Video Solution

5. A car is moving with a speed of the $72Kmh^{-1}$ towards a hill. Car blows horn at a distance of 1800 m from the hill. If echo is heard after 10 s.the speed of sound $\left(\text{in}ms^{-1}\right)$ is

A. 300

B. 320

C. 340

D. 360

Answer: C

Watch Video Solution

6. The faintest sound the human ear can detect at a frequency of 1kHz (for which the ear is most sensitive) corresponds to an intensity of about $10^{-12} W/m^2$ (the so called threshold of hearing). Determine the pressure amplitude and maximum displacement associated with this sound assuming the density of air = $1.3 kg/m^2$ and velocity of sound in air = 332 m/s

A. $2.94 \times 10^{-5} N/m^2, 1.1 \times 10^{-11} m$

B. $2.94 \times 10^{-4} N/m^2, 1.3 \times 10^{-11} m$

C. $2.94 \times 10^{-1} N/m^2, 1.2 \times 10^{-11} m$

D. $2.94 \times 10^{-3} N/m^2, 1.5 \times 10^{-11} m$

Answer: A

Watch Video Solution

7. The speaker of a public address system emits 20 kW power, considering it a point source. What is the sound intensity level at a point 4.00 m away?

A. 100 dB

B. 140dB

C. 120dB

D. 125dB

Answer: B

Watch Video Solution

8. A plane longitudinal wave having angular frequency ω = 500 rad /sec is travelling in positive x-direction in a medium of density ρ =1 kg/m and bulk modulus $4 \times 10^4 N/m^2$. The loudness at a point in the medium is observed to be 20 dB. Assuming at x = 0 initial phase of the medium particles to be zero, find the equation of the wave

A. $y = 2 \times 10^{-9}\sin\left(500t - \frac{5x}{2}\right)$

B. $y = 3 \times 10^{-9}\sin\left(500t + \frac{5x}{2}\right)$

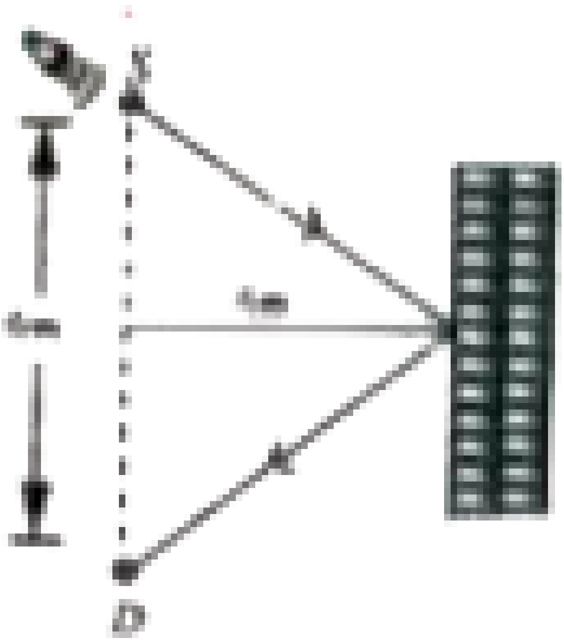
C. $y = 3 \times 10^{-9}\sin\left(500t + \frac{5x}{2}\right)$

D. $y = 2 \times 10^{-9}\sin\left(5000t - \frac{5x}{2}\right)$

Answer: A

Watch Video Solution

9. A person standing at a distance of 6 m from a source of sound receives sound wave in two ways, one directly from the source and other after reflection from a rigid boundary as shown in the figure. The maximum wavelength for which, the person will receive maximum sound intensity, is



A. 4m

B. $\frac{16}{3}$ m

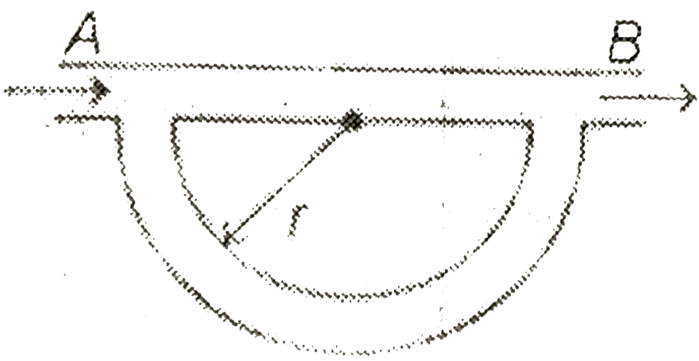
C. 2m

D. $\frac{8}{3}$ m

Answer: A

Watch Video Solution

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

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

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

Answer: B

Watch Video Solution

11. Two sources S_1 and S_2, each emitting waves of wavelength λ are kept symmetrically on either side of centre o of a circle ABCD such that $S_1O = S_2O = 2\lambda$. If a detector is moved along the circumference of the circle, it will record how many maximum in one revolution

A. 8

B. 12

C. 16

D. 24

Answer: A

Watch Video Solution

LECTURE SHEET (EXERCISE-IV (LEVEL-II(ADVANCED) STRAIGHT OBJECTIVE TYPE QUESTIONS))

1. A sample of oxygen at NTP has volume V and a sample of hydrogen at NTP has the volume 4V. Both the gases are mixed. If the speed of sound in hydrogen at NTP is 1270 m/s, that in mixture is

A. 317 m/s

B. 635 m/s

C. 830 m/s

D. 950 m/s

Answer: B

Watch Video Solution

2. A soldier walks towards a high wall taking 120 steps per minute. When he is at a distance of 90 m from the wall he observes that echo of step coincides with the next step. The speed of sound must be

A. 340 m/s

B. 330 m/s

C. 300 m/s

D. 360 m/s

Answer: D

Watch Video Solution

3. A mixture of two diatomic gases exists in a closed cylinder. The volumes and velocities of sound in the two gases are V_1, V_2, c_1 and c_2 respectively. Determine the velocity of sound in the gaseous mixture. (Pressure of gas remains constant),

A. $c_1c_2\sqrt{\dfrac{V_1 + V_2}{V_1c_2^2 + V_2c_1^2}}$

B. $c_2c_1\sqrt{\dfrac{V_2^2 + V_1^2}{V_1c_2^2 + V_2c_1^2}}$

C. $c_2c_1\sqrt{\dfrac{V_2 - V_1}{V_1c_2^2 - V_2c_1^2}}$

D. $c_1c_2\sqrt{\dfrac{V_2 + V_1}{V_1c_1^2 - V_2c_2^2}}$

Answer: A

Watch Video Solution

4. Assume that temperature varies linearly with height near the Earth's surface. Considering temperature at the surface of the Earth T_1 and T_2 at a height h above the surface, calculate the time t needed for a sound wave produced at a height. x. to reach the Earth's surface. Velocity of sound at the Earth's surface is c.

A. $t = \frac{2h}{c}\frac{\sqrt{T_1}}{\left(T_2 - T_1\right)}\left[\sqrt{T_1} - \sqrt{\frac{T_2 - T_1}{h}x + T_1}\right]$

B. $t = \frac{2h}{c}\frac{\sqrt{T_1}}{\left(T_1 - T_2\right)}\left[\sqrt{T_1} - \sqrt{\frac{T_2 - T_1}{h}x + T_1}\right]$

C. $t = \frac{3h}{c}\frac{\sqrt{T_1}}{\left(T_2 - T_1\right)}\left[\sqrt{T_1} - \sqrt{\frac{T_2 - T_1}{h}x + T_1}\right]$

D. $t = \frac{6h}{c}\frac{\sqrt{T_1}}{\left(T\_2 - T_1\right)}\left[\sqrt{T_1} - \sqrt{\frac{T_2 - T_1}{h}x + T_1}\right]$

Answer: B

Watch Video Solution

5. A dog while barking delivers about 1 mW of power. If this power is uniformly distributed over a hemispherical area, what is the sound level at a distance of 5 m? What would the sound level be if instead of 1 dog, 5 dogs start barking at the same time each delivering 1 mW of power

A. 68 dB, 75 dB

B. 58 dB, 68 dB

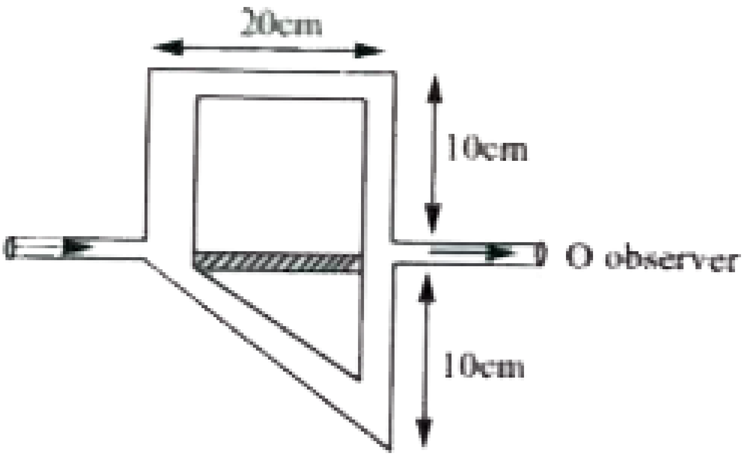
C. 48 dB, 58 dB

D. 38 dB, 28 dB

Answer: A

Watch Video Solution

6. Find out frequency at which maximum intensity detected by observer O. If velocity of sound $= 340 m/s^{-1}$ and frequency range of source 2000 Hz to 5000 Hz



A. 3350 Hz

B. 4250 Hz

C. 2900 Hz

D. None of these

Answer: B

Watch Video Solution

LECTURE SHEET (EXERCISE-IV (LEVEL-II(ADVANCED) MORE THAN ONE CORRECT ANSWER TYPE QUESTIONS))

1. As a wave propagates

A. the wave intensity remains constant for a plane wave

B. the wave intensity decrease as the inverse of the distance from the source for a spherical wave

C. the wave intensity decrease as the inverse square of the distance from the source for spherical wave.

D. total intensity of the spherical wave over the spherical surfacE remains constant at all times, while source is at the centre of spherical surface

Answer: A::C::D

Watch Video Solution

LECTURE SHEET (EXERCISE-IV (LEVEL-II(ADVANCED) LINKED COMPREHENSION TYPE QUESTIONS))

1. A plane longitudinal wave of angular frequency ω=1000 rad/s is travelling along positive x direction in a homogeneous gaseous medium of density $d = 1kgm^{-3}$. Intensity of wave is $I = 10^{-10}W.m^{-2}$ and maximum pressure change is $(\Delta P)_m = 2 \times 10^{-4}Nm^{-2}$. Assuming at x = 0, initial phase of medium particles to be zero

Amplitude of the travelling wave is

(a) $10^{-6}m$

(b) $10^{-7}m$

(c) $10^{-9}m$

(d) $2 \times 10^{-8}m$

A. $10^{-6}m$

B. $10^{-7}m$

C. $10^{9}m$

D. $2 \times 10^{-8} m$

Answer: C

Watch Video Solution

2. A plane longitudinal wave of angular frequency ω=1000 rad Is is travelling along positive x direction in a homogeneous gaseous medium of density $d = 1kgm^{-3}$. Intensity of wave is $I = 10^{-10} W.m^{-2}$ and maximum pressure change is $(\Delta P)_m = 2 \times 10^{-4} Nm^{-2}$. Assuming at x = 0, initial phase of medium particles to be zero

Velocity of the wave is

A. $500 ms^{-1}$

B. $100 ms^{-1}$

C. $300 ms^{-1}$

D. $200 ms^{-1}$

Answer: D

Watch Video Solution

3. A plane longitudinal wave of angular frequency ω=1000 rad Is is travelling along positive x direction in a homogeneous gaseous medium of density $d = 1kgm^{-3}$. Intensity of wave is $I = 10^{-10}W. m^{-2}$ and maximum pressure change is $(\Delta P)_m = 2 \times 10^{-4}Nm^{-2}$. Assuming at x = 0, initial phase of medium particles to be zero

Velocity of the wave is

A. $y = 10^{-9}\sin(1000t - 5x)m$

B. $y = 10^{-7}\sin(200t - x)m$

C. $y = 10^{-6}\sin(5000t - 500x)$

D. $y = 2 \times 10^{-8}m\sin(600t - 2x)$

Answer: A

Watch Video Solution

LECTURE SHEET (EXERCISE-IV (LEVEL-II(ADVANCED) MATRIX MATCHING TYPE QUESTIONS))

1. Match the following

Column - I	Column - II
A) Reflection in rigid surfaces	p) $f > 20{,}000$ Hz
B) Ultra sonic waves	q) phase change of π radians
C) Reflection at free boundary	r) directon of propagation changes
D) Echo	s) no phase change

Watch Video Solution

LECTURE SHEET (EXERCISE-V (LEVEL-I(MAIN) STRAIGHT OBJECTIVE TYPE QUESTIONS))

1. At a particular locus, frequency of 'A' allele is $0.6$and that of $'a'$ is 0.4 . What would be the frequency of heterozygotes in a random mating population at equilibrium ?

A. $3f_0/4$

B. f_0

C. $f_0/2$

D. $2f_0$

Answer: B

Watch Video Solution

2. An open organ pipe and closed pipe have same length. The ratio of frequencies of their n^{th} over tone 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

3. Fundamental frequency of pipe is 100 Hz and other two frequencies are 300 Hz and 500 Hz then

A. Pipe is open at both the ends

B. pipe is closed at both the ends

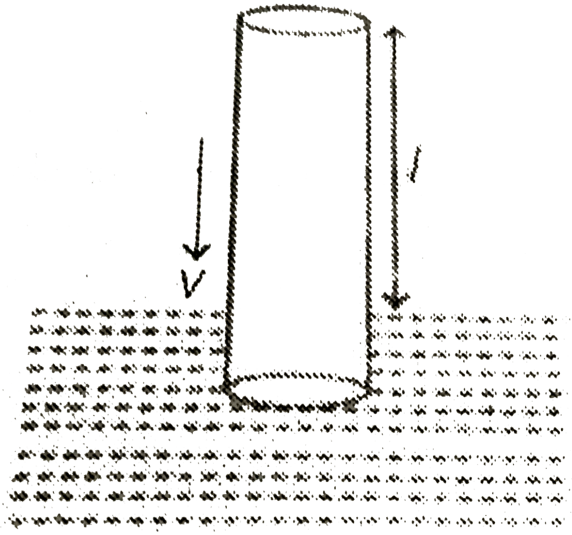
C. One end open and another end is closed

D. None of the above

Answer: C

Watch Video Solution

4. 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. $cv/2l^2$

B. $cv/4l^2$

C. $c/2v^2l^2$

D. $c/4v^2l^2$

Answer: B

Watch Video Solution

5. The frequency of a tuning fork A is 5% greater than that of a standard fork K. The frequency of another fork B is 3% less than that of K. When A and B are vibrated simultaneously 4 beats per second are heard. Find the frequencies of A and B.

A. 52.5 Hz, 48.5 Hz

B. 63.5 Hz, 79.5 Hz

C. 10.5 Hz, 101 Hz

D. 124 Hz, 120 Hz

Answer: A

Watch Video Solution

6. Tuning fork A of frequency 258 Hz gives 8 beats with a tuning fork B. When the tuning fork A is filed and again A and B are sounded the number of beats heard decreases. The frequency of B is

A. 250 Hz

B. 266 Hz

C. 258 Hz

D. 242 Hz

Answer: B

Watch Video Solution

7. Wavelengths of two notes in air are 80/175 m and 80/173 m. Each note produces 4 beats/s, with a third note of a fixed frequency. The speed of sound in air is

A. 400 m/s

B. 300 m/s

C. 280 m/s

D. 320 m/s

Answer: D

Watch Video Solution

8. Figure shows a wire ring of radius a that is perpendicular to the general direction of a radially sysmmetric, diverging magnetic field. The magnetic field at the ring is everywhere of the same magnitude B, and its direction at the ring everywhere makes an angle θ with a normal to the plane of the ring. thge twisted lead wires have no effect on the problem. Find the magnitude of the force the field exerts on the ring if the ring carries a current i.

A. 0.02

B. 0.03

C. 0.01

D. 0.04

Answer: D

Watch Video Solution

LECTURE SHEET (EXERCISE-V (LEVEL-II(ADVANCED) STRAIGHT OBJECTIVE TYPE QUESTIONS))

1. An open organ pipe of length l vibrates in its fundamental mode. The pressure variation is maximum

A. at the two ends

B. at a distance L/4 from either end inside the tube

C. at the mid-point of the tube

D. none of these

Answer: B

Watch Video Solution

2. A tuning fork of frequency $340Hz$ is excited and held above a cylindrical tube of length $120cm$. It is slowly filled with water. The minimum height of water column required for resonance to be first heard(Velocity of sound $= 340ms^{-1}$) is.

A. 95cm

B. 75cm

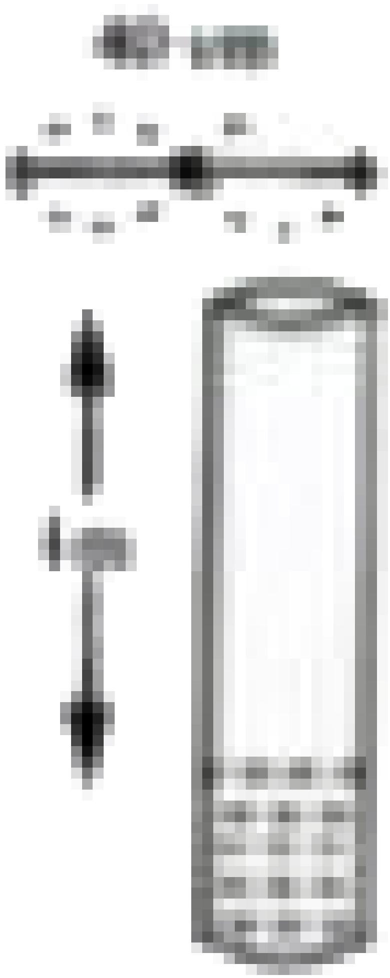
C. 45cm

D. 25cm

Answer: C

Watch Video Solution

3. A wire of length 40 cm which has a mass of 4 gms oscillates in its second harmonic and sets the air column in the tube to vibrations in its fundamental mode as shown in figure. Assuming speed of sound in air as 340 m/s, find the tension in the wire.



A. 11.56 N

B. 12.54 N

C. 13. 46 N

D. 11. 36 N

Answer: A

Watch Video Solution

4. A pipe's lower end is immersed in water such that the length of air column from the top open end has a certain length 25 cm. The speed of sound in air is 350 m/s. The air column is found to resonate with a tuning fork of frequency 1750 Hz. By what minimum distance should the pipe be raised in order to make the air column resonate again with the same tuning fork?

(a) 7cm

(b) 5cm

(c) 35cm

(d) 10cm

A. 7cm

B. 5cm

C. 35cm

D. 10cm

Answer: D

Watch Video Solution

5. Two sounding bodies are producing progressive waves given by $y_1 = 4\sin(400\pi t)$and $y_2 = 3\sin(404\pi t)$, where t is in second which superpose near the ears of a person. The person will hear

A. 2 beats per second with intensity ratio $\frac{4}{3}$ between maxima and minima

B. 2 beats per second with intensity ratio 49 between maxima and minima

C. 4 beats per second with intensity ratio 7 between maxima and minima

D. 4 beats per second with intensity ratio $\frac{4}{3}$ between maxima and minima

Answer: B

Watch Video Solution

6. In an organ pipe whose one end is at x =0, the pressureis expressed by $P = P_0 \cos \frac{3\pi x}{2} \sin 300\pi t$ where x is in meter and t in sec. The organ pipe can be :-

A. closed at one end, open at another with length = 0.5m

B. open at both ends, length = 1m

C. closed at both ends, length = 2m

D. closed at one end, open at another with length = $\frac{2}{3}$m

Answer: C

Watch Video Solution

7. A tuning fork and an organ pipe at temperature $88^{\circ}C$ produce 5 beats per second. When the temperature of the air column is decreased to $51^{\circ}C$ the two produce 1 beat per sec. What is the frequency of the tuning fork?

A. f'=81Hz

B. f'= 71Hz

C. f'=110 Hz

D. f'= 55 Hz

Answer: B

Watch Video Solution

Watch Video Solution

8. A string under a tension of 129.6 N produces 10 beats per sec when it is vibrated along with a tuning fork. When the tension in the string is increased to 160 N, it sounds in unison with the same tuning fork, Calculate the fundamental frequency of the tuning fork.

A. 88 Hz

B. 100 Hz

C. 110 Hz

D. 121 Hz

Answer: B

Watch Video Solution

LECTURE SHEET (EXERCISE-V (LEVEL-II(ADVANCED) MORE THAN ONE CORRECT ANSWER TYPE QUESTIONS))

1. Along the straight line joining two consecutive displacement nodes in a pure stationary sound wave at different points

A. the S.H.M's will be in different phases

B. Velocities are in phase

C. the accelerations are in phase

D. frequencies are equal

Answer: B::C::D

Watch Video Solution

2. Two choherent waves represented by $y_1 = A\sin\left(\frac{2\pi x_1}{\lambda} - wt + \frac{\pi}{3}\right)$ and $y_2 = A\sin\left(\frac{2\pi x_2}{\lambda} - wt + \frac{\pi}{6}\right)$ are superposed. The two waves will produce

A. Constructive interference at $(x_1 - x_2) = 2\lambda$

B. Constructive interference at $(x_1 - x_2) = \frac{23\lambda}{24}$

C. destructive interference at $(x_1 - x_2) = 1.5\lambda$

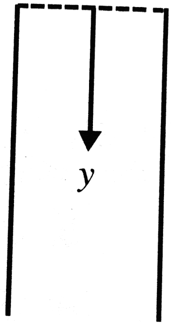
D. destructive interference $(x_1 - x_2) = \frac{11\lambda}{24}$

Answer: B::D

Watch Video Solution

LECTURE SHEET (EXERCISE-V (LEVEL-II(ADVANCED) LINKED COMPREHENSION TYPE QUESTIONS))

1. In an organ pipe (may be closed or open) of $99 cm$ length standing wave is set up , whose equation is given by longitudinal displacement.



$\xi = (0.1mm)\frac{\cos(2\pi)}{0.8}(y + 1cm)\cos(400)t$where y is measured from the top of the tube in $metres$ and $t in seconds$. Here $1cm$ is the end correction.

The air column is vibrating in

A. First overtone

B. Fifth harmonic

C. Third harmonic

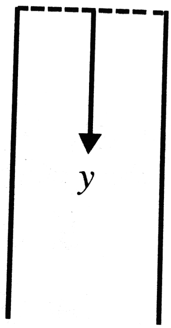
D. Fundamental mode

Answer: B

Watch Video Solution

Watch Video Solution

2. In an organ pipe (may be closed or open) of $99cm$ length standing wave is set up , whose equation is given by longitudinal displacement.



$\xi = (0.1mm)\frac{\cos(2\pi)}{0.8}(y + 1cm)\cos(400)t$where y is measured from the top of the tube in $metres$ and $t in seconds$. Here $1cm$ is the end correction.

The air column is vibrating in

A. $P_{ex} = \left(125\pi N/m^2\right)\frac{\sin(2\pi)}{0.8}(y + 1cm)\cos 2\pi(400t)$

B. $P_{ex} = \left(125\pi N/m^2\right)\frac{\cos(2\pi)}{0.8}(y + 1cm)\sin 2\pi(400t)$

C. $P_{ex} = \left(225\pi N/m^2\right)\frac{\sin(2\pi)}{0.8}(y + 1cm)\cos 2\pi(200t)$

D. $P_{ex} = \left(225\pi N/m^2\right)\frac{\cos(2\pi)}{0.8}(y + 1cm)\sin 2\pi(200t)$

Answer: A

Watch Video Solution

LECTURE SHEET (EXERCISE-V (LEVEL-II(ADVANCED) MATRIX MATCHING TYPE QUESTIONS))

1. Consider a situation (i) that two sound waves, $y_1 = (0.2m)\sin 504\pi(t - x/300)$ and $y_2 = (0.6m)\sin 496\pi(t - x/300)$, are superimposed. Consider another situation (ii) that two sound waves, $y'_1 = (0.4m)\sin 504\pi(t - x/300)$ and $y'_2 = (0.4m)\sin 504\pi(t + x/300)$, are superimposed.

Match the Column-I and Column-II

Column-I	Column-II
(A) In situation (i)	(p) Stationary waves are formed
(B) In situation (ii)	(q) There will be the phenomenon of 'Beats'
(C) When two waves of same frequency and amplitude and travelling in opposite directions superimpose	(r) Amplitude of the resultant wave will vary periodically with position
(D) If the intensity of sound alternately increases and decreases periodically as a result of superposition of waves of slightly different frequency	(s) Amplitude of the resultant wave will vary periodically
	(t) Amplitude of the resultant wave is constant

Watch Video Solution

LECTURE SHEET (EXERCISE-V (LEVEL-II(ADVANCED) INTEGER TYPE QUESTIONS))

1. A closed organ pipe and an open organ pipe of same length produce 4 beats when they are set into vibrations simultaneously. If the length of each of them were twice their initial lengths, the number of beats produced will be

Watch Video Solution

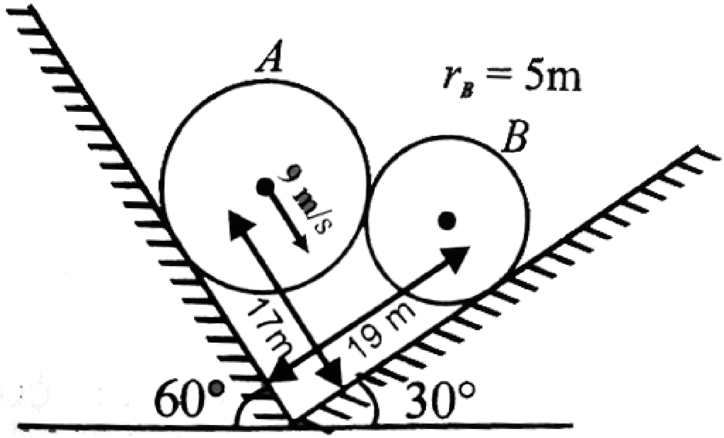
2. A glass tube 1.5 m long and open at both ends is immersed vertically in a water tank completely. A tuning fork or 660 Hz. Is vibrated and kept at the upper end of the tube and the tube is gradually raised out of water . The total number of resonances heard before the tube comes out of water taking velocity of sound air 330 m//sec is

Watch Video Solution

3. A pop-gun consists of a cylindrical barrel 3cm2 in cross-section closed at one end by a cork and having a well fitting piston at the other. If the piston is pushed slowly in, the cord is finally ejected, giving a pop, the frequency of which is found to be 512Hz. Assuming that the initial distance between the cork and the piston was 25cm and there is no leakage of air, If the force required to eject the cork is 0.75 x xkg-wt. Find the value of x. Atmospheric pressure = $1kgwt/cm^2$, v = 340 m/s.

Watch Video Solution

LECTURE SHEET (EXERCISE-VI (LEVEL-I(MAIN) STRAIGHT OBJECTIVE TYPE QUESTIONS))

1. 

System is shown in the figure. Velocity of sphere A is 9 $\frac{m}{s}$. Find the speed of sphere B.

A. $30ms^{-1}$

B. $15\sqrt{2}ms^{-1}$

C. $15\sqrt{2}ms^{-1}$

D. $15ms^{-1}$

Answer: D

Watch Video Solution

2. A satellite can be in a geostationary orbit around the earth at a distance r from the centre. If the angular velocity of earth about its axis doubles, a satellite can now be in a geostationary orbit around earth if its distance from the centre is :

A. 0.05

B. 0.2

C. 0

D. 0.005

Answer: B

Watch Video Solution

Watch Video Solution

3. Two trains are moving towards each other at speeds of 144 km/hr and 54 km/hr relative to the ground. The first train sounds a whistle of frequency 600 Hz. Find the frequency of the whistle as heard by a passenger in the second train before the trains meet. (y =340m/s)

A. 610 Hz

B. 510 Hz

C. 710 Hz

D. 170 Hz

Answer: C

Watch Video Solution

4. The apparent wavelength of light from a star moving away from earth is observed to be 0.01% more than its real wavelength. The velocity of star is

A. $120 kms^{-1}$

B. $90 kms^{-1}$

C. $60 kms^{-1}$

D. $30 kms^{-1}$

Answer: D

Watch Video Solution

5. A rocket is receding away from earth with velocity 0.2C. The rocket emits signal of frequency $4 \times 10^7 Hz$. The apparent frequency of the signal produced by the rocket observed by the observer on earth will be

A. $3 \times 10^6 Hz$

B. $2 \times 10^6 Hz$

C. $2.4 \times 10^7 Hz$

D. $3.2 \times 10^7 Hz$

Answer: D

Watch Video Solution

6. If interference is complete or cent percent then the frequency of observed crossover will be

A. 33.3 Hz

B. 50 Hz

C. 66.6 Hz

D. 75 Hz

Answer: C

Watch Video Solution

7. A person is listening to two trains one approaching him while the other moving away from him. The speed of both the trains is 5 m/s. If both trains give off whistle of their nature frequency of 280 Hz then the observer will hear ... no of beats/s. (Velocity of sound = 350 m/s)

A. 6

B. 7

C. 5

D. 8

Answer: D

Watch Video Solution

8. Two different sound sources s_1 and s_2 have frequencies ratio 1:2. Source s, is approaching towards an observer and s_2 is receding from the same observer. Speeds of both s_1 and s_2 are the same and equal to v. speed of sound in air in 300 m/s. If no beats are heard by the observer the value of V is 1

A. 125 m/s

B. 100 m/s

C. 75 m/s

D. 50 m/s

Answer: B

Watch Video Solution

9. A siren placed at a railway platfrom is emitted sound of frequency $5kH_Z$, A passenger sitting in retun journey in a different train B he records a frequency of $6.0kH_Z$ while approaching the same siren. The ratio of the velocity of train B to that of train A is

A. $\frac{242}{252}$

B. 2

C. $5/6$

D. $11/6$

Answer: B

Watch Video Solution

10. A spectral line is obtained from a gas discharge tube at 5000Å. If the rms velocity of gas molecules is $10^5 ms^{-1}$, then the width of spectral line will be

A. 3.3Å

B. 4.8Å

C. 7.2Å

D. 9.1Å

Answer: A

Watch Video Solution

11. An observer measures speed of light to be C, when he is stationary with respect to the source. If the observer moves with velocity V towards the source then the velocity of light observed will be

A. C - V

B. C + V

C. $\sqrt{1 - \frac{V^2}{C^2}}$

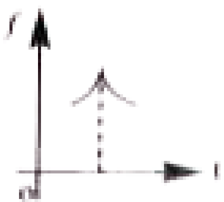
D. C

Answer: D

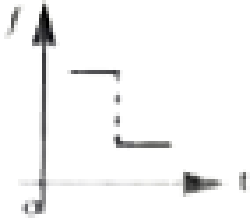
Watch Video Solution

LECTURE SHEET (EXERCISE-VI (LEVEL-II(ADVANCED) STRAIGHT OBJECTIVE TYPE QUESTIONS))

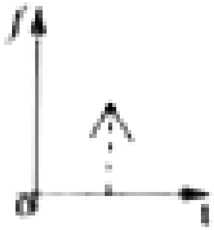
1. A source of sound emitting a note of constant frequency is moving towards a stationary listener and then recedes from the listener with constant velocity maintained throughout the motion. The frequency heard by the listener (f). when plotted against time (t) will give the following curve(s).



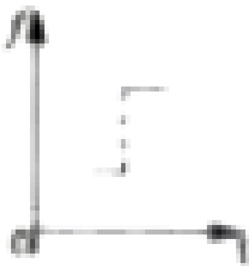
A.



B.



C.



D.

Answer: B

Watch Video Solution

2. 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. 0.143

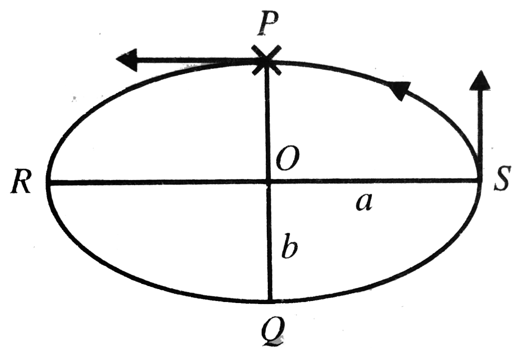
B. 0.2

C. 0.1

D. 0.0833

Answer: D

Watch Video Solution



3.

A train is moving in an elliptical orbit in anticlockwise sense with a speed of $110\frac{m}{s}$. Guard is also moving in the given direction with same speed as that of train. The ratio of the length of major and minor axes is $\frac{4}{3}$. Driver blows a whistle of 1900 Hz at P, which is received by guard at S. The frequency received by guard is (velocity of sound $v = 330\frac{m}{s}$)

A. 1900 Hz

B. 1800 Hz

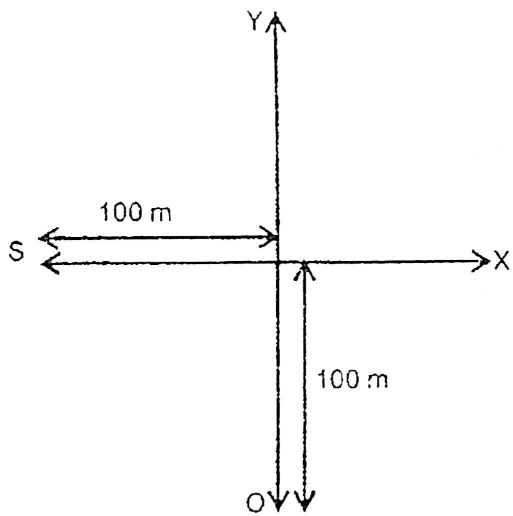
C. 2000 Hz

D. 1500 Hz

Answer: B

Watch Video Solution

4. At $t = 0$, a source of sonic oscillations S and on observer O start moving along x and y axes with $5m/s$ and $10m/s$. The figure shows their positions at $t = 0$. If frequency of source is $1000Hz$. Find the frequency of singals received after 5 second. $V_{sound} = 330m/\sec$.



A. 1020 Hz

B. 1010 Hz

C. 1030 Hz

D. 1100 Hz

Answer: C

Watch Video Solution

5. A source emitting a sound of frequency f is placed at a large distance from an observer. The source starts moving towards the observer with a uniform acceleration a. Find the frequency heard by the observer corresponding to the wave emitted just after the source starts. The speed of sound in the medium is v.

A. $\frac{Vv^2}{2Vv - a}$

B. $\frac{2V^2v}{2Vv - a}$

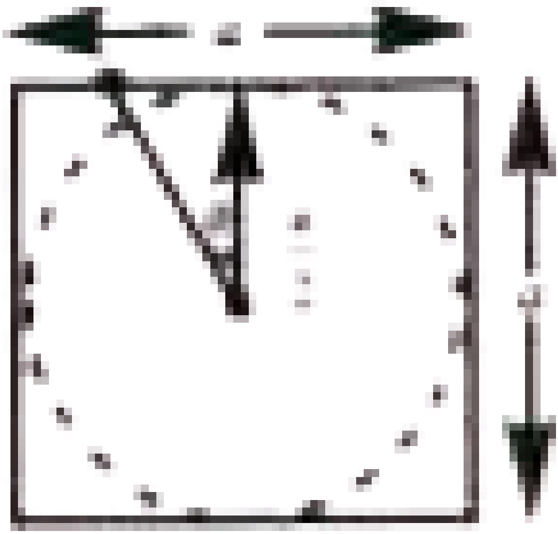
C. $\dfrac{2Vv}{Vv - a}$

D. $\dfrac{2Vv^2}{2Vv - a}$

Answer: B

Watch Video Solution

6. A square ground of side $a = \dfrac{10}{\sqrt{2}}$ m has a circular running track of radius a/2 with its centre coinciding the centre of the ground. A man is running on the track with an angular velocity ω = 22 rad /s while a car is moving on a road adjacent to ground as shown in the figure. The car moves in such away that the car, the man and the centre of the ground always lie on the same straight line. If a source of sound of frequency v = 300 Hz is being placed at the centre of the ground find the minimum frequency received by the man in the car. Assume velocity of sound in air is v = 330 m/s.



A. 200 Hz

B. 210 Hz

C. 190 Hz

D. None

Answer: A

Watch Video Solution

7. Consider two sound sources S_1 and S_2 having same frequency 100Hz and the observer O located between them as shown in the fig. All the three are moving with same velocity in same direction. The beat frequency of the observer is

A. 50Hz

B. 5 Hz

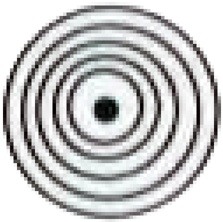
C. zero

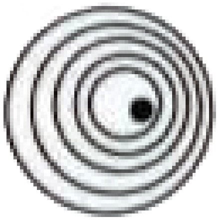
D. 2.5 Hz

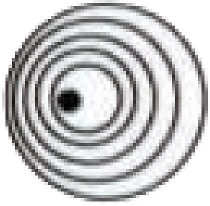
Answer: C

Watch Video Solution

8. If the source is moving towards right, wavefront of sound waves get modifies to

A. 

B. 

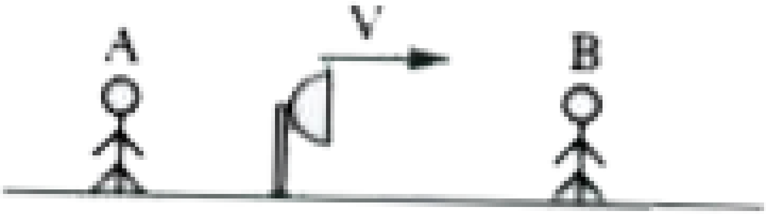
C. 

D. none of these

Answer: B

Watch Video Solution

9. When the source moves with a velocity v, the ratio of wavelengths received by A and B will be (c = speed of Sound):



A. $\frac{c+v}{c+v}$

B. $\frac{c-v}{c+v}$

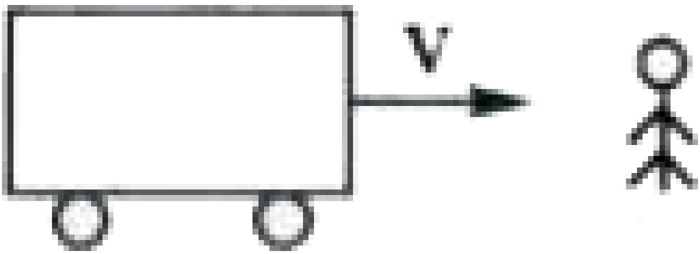
C. $\frac{c}{v}$

D. $\frac{c^2+v^2}{c^2-v^2}$

Answer: A

Watch Video Solution

10. A jeep passes by you with a speed v. If the speed of sound is c, the ratio of frequencies just before and after jeep passes you is 5/6. Then, the speed v= (Assume c= 330 m/s)



A. 20m/s

B. 30m/s

C. 25m/s

D. none of these

Answer: B

Watch Video Solution

11. A whistle of frequency f_0 = 1300 Hz is dropped from a height H = 505 m above the ground. At the same time, a detector is projected upwards with velocity $v = 50ms^{-1}$ along the same line. If the velocity of sound is $c = 300ms^{-1}$ find the frequency detected by the detector after t = 5s.

A. 500 Hz

B. 700 Hz

C. 1500 Hz

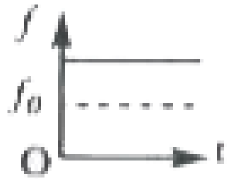
D. 2500 Hz

Answer: C

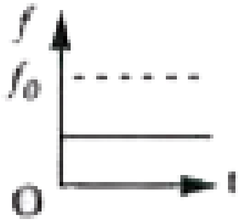
Watch Video Solution

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

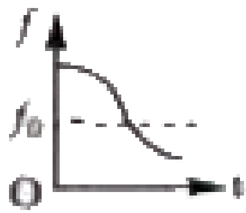
). The graph between the apparent frequency observed by observer (f) and time (t) would be



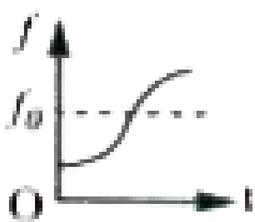
A.



B.



C.



D.

Answer: B

Watch Video Solution

LECTURE SHEET (EXERCISE-VI (LEVEL-II(ADVANCED) MORE THAN ONE CORRECT ANSWER TYPE QUESTIONS))

1. A sound wave of frequency f travels horizontally to the right . It is teflected from a larger vertical plane surface moving to left with a speed v. the speed of sound in medium is c

(a) The number of waves striking the surface per second is $\frac{f(c+\upsilon)}{c}$

(b) The wavelength of reflected wave is $\frac{c(c-\upsilon)}{f(c+\upsilon)}$

(c) The frequency of the reflected wave is $\frac{f((c+\upsilon))}{(c+\upsilon)}$

(d) The number of beats heard by a stationary listener to the left of the reflecting surface is $\frac{\upsilon f}{c-\upsilon}$

A. The frequency of the reflected wave is a $\frac{f(c+v)}{c-v}$

B. The wave length of the reflected wave is $\frac{c(c-v)}{f(c+v)}$

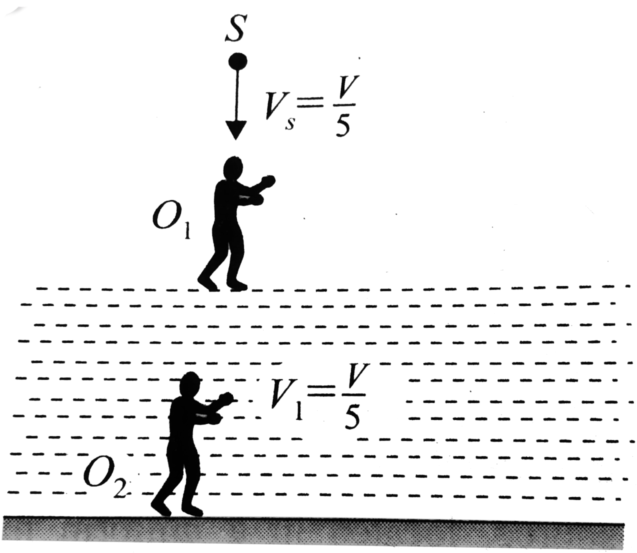
C. The number of waves striking the surface per second is $\frac{f(c+v)}{c}$

D. The number of beats heard by a stationary listener to the left of the reflecting surface is $\frac{fv}{c - v}$

Answer: A::B::C

Watch Video Solution

2.



In the figure shown, an observer O_1 floats (static) on water surface with ears in air while another observer O_2 is moving upwards with constant velocity $V_1 = \frac{V}{5}$ in water. The source moves down with constant velocity $V_S = \frac{V}{5}$ and emits sound of freqeuncy f. The velocity of sound in air is V and that in water is $4V$. For the situation shown in figure.

A. The wave length of the sound received by O_1 is 4v/5f

B. The wave length of the sound received by O_1 is v/f

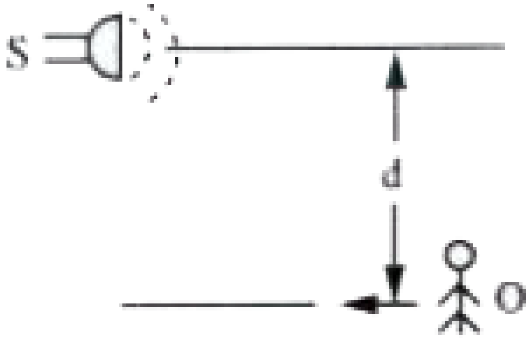
C. The frequency of the sound received by O_2 is 21f/16

D. The wavelength of the sound received by is $\frac{4v}{7f}$

Answer: A::C::D

Watch Video Solution

3. When a source and observer move in a parallel track as shown in the figure, the ratio of appeares and actual frequency can be



A. > 1

B. $= 1$

C. < 1

D. none of these

Answer: A::B

Watch Video Solution

4. A railroad train is travelling at 30.0 m/s in still air. The frequency of the note emitted by the train whistle is 262 Hz. Speed of sound in air is 340 m/s.

A. Frequency heard by a passenger on another train moving in the opposite direction to the first at 18.0 m/s and approaching the first is 302 Hz

B. Frequency heard by a passenger on another train moving in the opposite direction to the first at 18.0 m/s and receding from the first is 228 Hz

C. Frequency heard by a passenger on another train moving in the same direction of the first at 18.0 m/s and approaching the first is 272 Hz

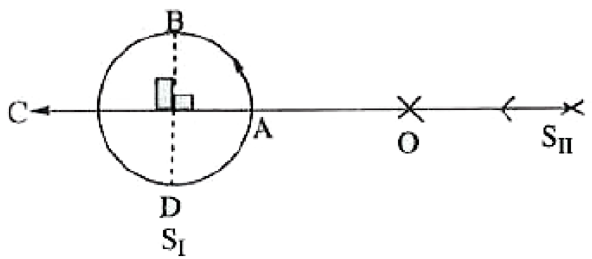
D. Frequency heard by a passenger on another train moving in the same direction of the first at 18.0 m/s and receding the first is 253 Hz

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

Watch Video Solution

LECTURE SHEET (EXERCISE-VI (LEVEL-II(ADVANCED) LINKED COMPREHENSION TYPE QUESTIONS))

1. As shown in the figure two sources producing sound Sr and Sn (velocity of sound 360 m/sec) each producing sound of frequency 200 Hz. S_1 is rotating anti clock wise where as S_n is approaching observer O each with a speed 10 m/sec. (neglect radius of circular path of S_1), then calculate



Range of number of beats received by observer O at rest is (nearly)

A. 0 to 11.2

B. 0 to 5.7

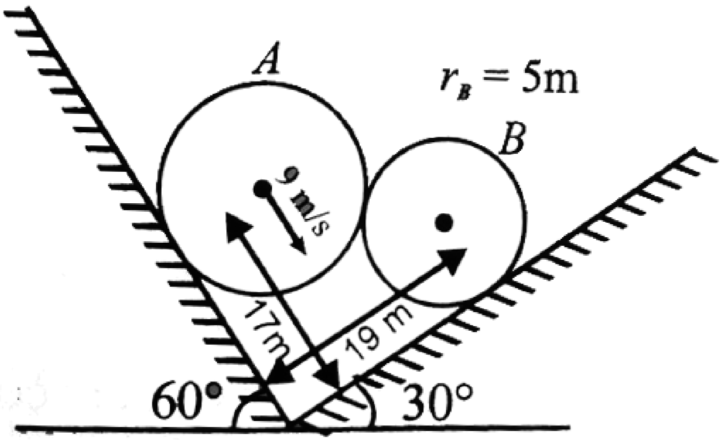
C. 1 to 4

D. 0 to 7.5

Answer: A

Watch Video Solution

2.



System is shown in the figure. Velocity of sphere A is 9 $\frac{m}{s}$. Find the speed of sphere B.

A. 2.5m/sec

B. 5.5 beats/sec

C. 3 beats/sec

D. beats cannot be distinguished

Answer: B

Watch Video Solution

3. There is a detective submarine installed inside sea water post 26/11 incident to detect terrorists. It is moving with constant speed V_θ along a straight line and it sends a wave which travels with speed V_w = 1100m/sec in water. Initially waves are getting reflected from a fixed Island and the frequency detected by the submarine is found to be 20% more than the original frequency. When a terrorist ship moving towards the submarine with constant speed V_s comes in between the submarine and the island. Frequency of waves reflected from the ship is 80% more than the original frequency.

Bulk modulus of sea water is

A. 50 m/sec

B. 100 m/sec

C. 10 m/s

D. 25 m/sec

Answer: B

Watch Video Solution

4. There is a detective submarine installed inside sea water post 26/11 incident to detect terrorists. It is moving with constant speed V_θ along a straight line and it sends a wave which travels with speed V_w = 1100m/sec in water. Initially waves are getting reflected from a fixed Island and the frequency detected by the submarine is found to be 20% more than the original frequency. When a terrorist ship moving towards the submarine with constant speed V_s comes in between the submarine and the island. Frequency of waves reflected from the ship is 80% more than the original frequency.

Bulk modulus of sea water is

A. 220 m/sec

B. 110 m/s

C. 200 m/s

D. none

Answer: A

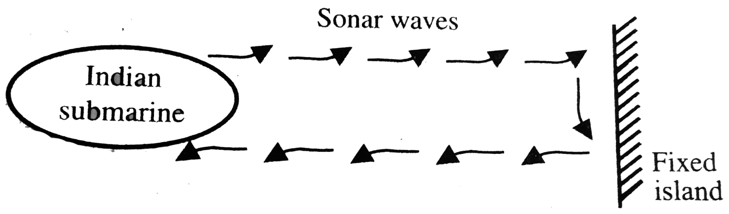
Watch Video Solution

5. An indian submarine is moving in the Arabian sea with constant velocity. To detect enemy it sends out sonar waves which travel with velocity $1050\frac{m}{s}$ in water. Initially the waves are getting reflected from a fixed island and the reflected waves are coming back to submarine. The frequency of reflected waves are detected by the submarine and found to be 10 % greater than the sent waves.

Now an enemy ship comes in front, due to which the frequency of reflected waves detected by submarine becomes 21 % greater than the sent waves.

Q. Bulk modulus of sea water should be approximately

$\left(\rho =_{water} = 1000\frac{kg}{m^3}\right)$



A. $10^9 N/m^2$

B. $1.21 \times 10^9 N/m^2$

C. $1.5 \times 10^2 N/m^2$

D. none

Answer: B

Watch Video Solution

6. An observer is moving with a constant speed of 20m/s on a circular track of radius 50m. A source kept at centre of track emits a sound of frequency 200 Hz. Then the frequency received by the observer is $x \times 10^2$ Hz, what is value of x. (V= 340m/s)

Watch Video Solution

7. Two identical tuning forks vibrating at the same frequency 256 Hz are kept fixed at some distance apart. A listener runs between the forks at a speed of $3.0ms^{-1}$ so that he approaches one tuning-fork and recedes from the other. find the beat frequency observed by the listener. Speed of sound in air $= 332ms^{-1}$.

Watch Video Solution

8. Does the escape speed of a body from the earth depend on.

(i)mass of the body

(ii)the location from where it is projected

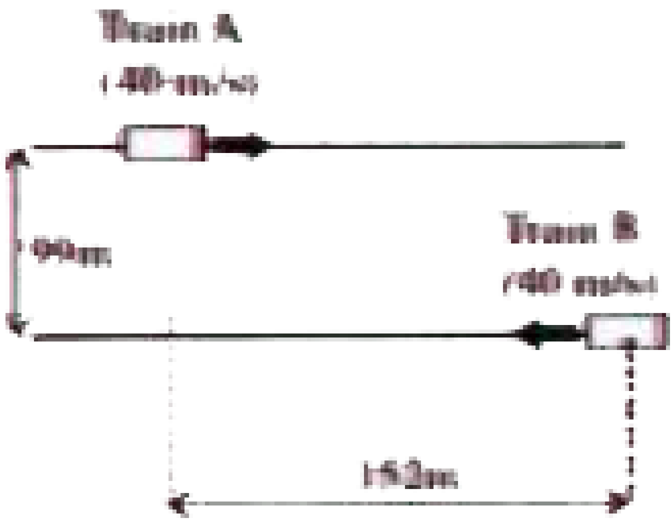
(iii)the direction of projection

(iv)the height of the location from where the body is launched?

Watch Video Solution

LECTURE SHEET (EXERCISE-VI (LEVEL-II(ADVANCED) MATRIX MATCHING TYPE QUESTION))

1. Train A and B are approaching towards each other on a parallel track 99 m apart at t = 0 their position are shown. Train A whistles a short pulse of frequency of 596 Hz. Velocity of sound is 330 m/s.



Watch Video Solution

LECTURE SHEET (EXERCISE-VI (LEVEL-II(ADVANCED) INTEGER TYPE QUESTIONS))

1. 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

Watch Video Solution

PRACTICE SET (EXERCISE-I (LEVEL-I(MIAN)STRAIGHT OBJECTIVE TYPE QUESTIONS))

1. The time lag between two particles vibrating in a progressive wave seperated by a distance 20m is 0.02s. The wave velocity if the frequency of the wave is 500Hz, is

A. $1000ms^{-1}$

B. $500ms^{-1}$

C. $2000ms^{-1}$

D. $250ms^{-1}$

Answer: A

Watch Video Solution

2. The path difference between the two waves :

$y_1 = a_1 \sin\left(\omega t - \frac{2\pi x}{\lambda}\right)$ and

$y_2 = a_2 \cos\left(\omega t - \frac{2\pi x}{\lambda} + \phi\right)$ is

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

B. $\frac{\lambda}{2\pi}\left(\phi + \frac{\pi}{2}\right)$

C. $\frac{2\pi}{\lambda}\left(\phi - \frac{\pi}{2}\right)$

D. $\frac{2\pi}{\lambda}\phi$

Answer: B

Watch Video Solution

3. The maximum particle velocity is 3 times the wave velocity of a progressive wave. If the amplitude of the particle is "a". The phase difference between the two particles seperated by a distance of 'x' is

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

B. $\frac{3x}{a}$

C. $\frac{3a}{x}$

D. $\frac{3\pi x}{a}$

Answer: B

Watch Video Solution

4. Which of the following releations is correct ?

A. $(x - vt)^2$

B. $(x + vt)^2$

C. $e^{-(x-vt)^2}$

D. $\frac{1}{x + vt}$

Answer: C

Watch Video Solution

5. Which of the following is a true nut?

A. $y = A\sqrt{(x - vt)}$

B. $y = A\cos(ax + bt)$

C. $y = A\log(x - vt)$

D. $y = f\left(x^2 - vt^2\right)$

Answer: C

Watch Video Solution

PRACTICE SET (EXERCISE-I (LEVEL-II(ADVANCED)STRAIGHT OBJECTIVE TYPE QUESTIONS))

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

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

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-axis with speed $2m/s$?

A. $y = \dfrac{10}{\left(x^2 + 2y\right)^2 + 2}$

B. $y = \dfrac{10}{\left(x^2 + 2t\right)^2 + 2}$

C. $y = \dfrac{10}{(x - 2t)^2 + 2}$

D. $y = \dfrac{10}{(x+2t)^2 + 2t}$

Answer: C

Watch Video Solution

2. The displacement of A particle at x = 0 of a stretched string carrying a wave in the positive X-direction is given by $f(t) = Ae^{-t^2}$. The wave speed is V. Write equation of the wave.

A. $f(x, t) = Ae^{-(t+x)^2}$

B. $f(x, t) = Ae^{-\left(t - \frac{x}{v}\right)^2}$

C. $f(x, t) = Ae^{\left(t + \frac{x}{v}\right)^2}$

D. $f(x, t) = Ae^{-\left(t + \frac{x}{v}\right)^2}$

Answer: B

Watch Video Solution

3. The equation $y = A\cos^2\left(2\pi nt - 2\pi\frac{x}{\lambda}\right)$ represents a wave with

A. amplitude a, frequency n and wavelength λ

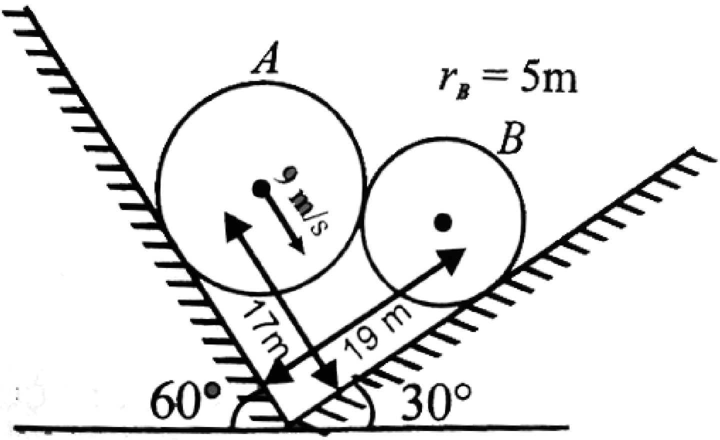
B. amplitude a, frequency 2n and wavelength λ

C. amplitude a/2, frequency 2n and wavelength λ

D. amplitude a/2, frequncy 2n and wavelength $\lambda/2$

Answer: D

Watch Video Solution

4. 

System is shown in the figure. Velocity of sphere A is 9 $\frac{m}{s}$. Find the speed of sphere B.

A. $y = 10\cos\left(\frac{x}{5} - 8t\right)$

B. $y = 10\sin\left(\frac{x}{5} - 8t\right)$

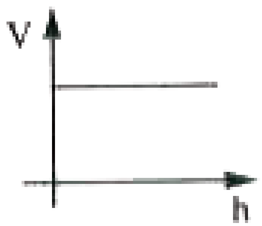
C. $y = 10\cos\left(\frac{x}{5} - 8t + 16\right)$

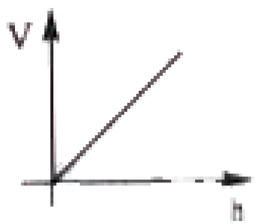
D. $y = 10\sin\left(\frac{x}{5} - 8t + 16\right)$

Answer: C

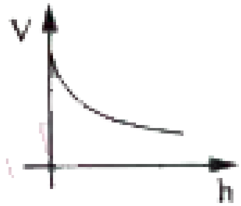
Watch Video Solution

5. 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. 

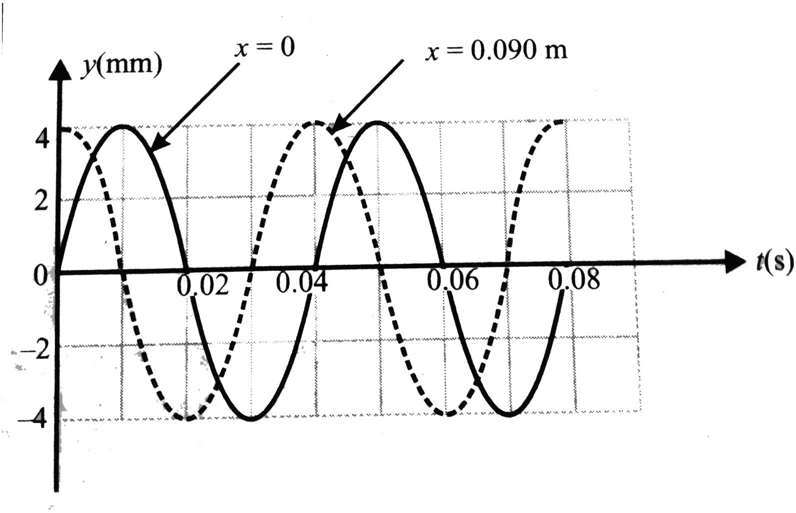
C. 

D. 

Answer: C

Watch Video Solution

6. A sinusoidal wave is propagating along a streched string that lies along the x-axis. The displacement of the string as a function of time is graphed in for particles at x-0 and at x=0.0900 m. (a) what is the amplitude of the wave? (b)what is the period of the wave? (c) you are told that the two points x=0 and x=0.0900 m are within one wavelength of each other. if the wave is moving in the +x-direction, determine the wavelength and the wave speed. (d) if instead the wave is moving in the -x-direction, determine the wavelength and the wave speed. (e) would it be possible to derermine definitely the wavelength in parts (c) and (d) if you were not told that the two points were within one wavelength of each other? why ot why not?



A. 3m/s

B. 3.8m/s

C. 9.1m/s

D. 2.2m/s

Answer: B

Watch Video Solution

7. A progressive wave has a shape (or waveform) given by the equation, $y = \frac{2}{\left(x^2 - 6x + 14\right)^{3/2}}$, at the instant time t = 1. Express the wave equation in terms of time t,

A. $y = \frac{2}{\left[5 + (x - 3t)^2\right]^{3/2}}$

B. $y = \frac{2}{\left[3 + (x - 3t)^2\right]^{3/2}}$

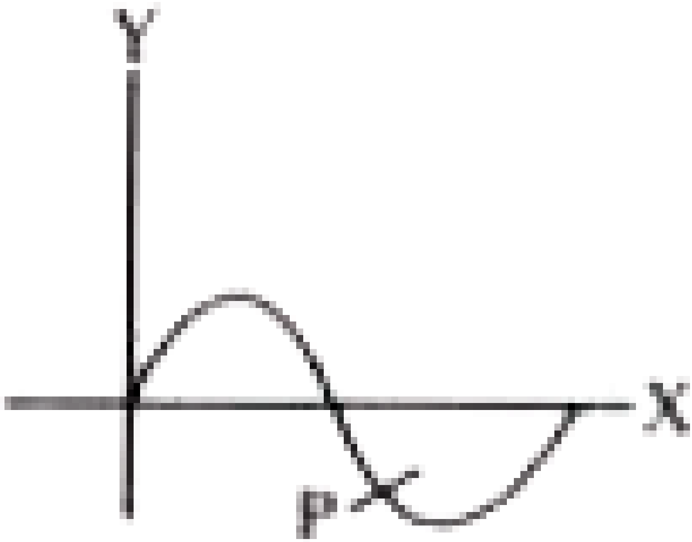
C. $y = \frac{2}{\left[3 + (x - 3t)^2\right]^{1/2}}$

D. $\frac{2}{\left[3 + (2x - 3t)^2\right]^{1/2}}$

Answer: A

Watch Video Solution

8. A travelling wave in a string has speed 5 cm/s in -ve x direction its amplitude is 10 mm and wavelength 1 m. At a particular time a point P has displacement $5\sqrt{3}$ mm. Find the velocity vector of point P ?



A. $\frac{\pi}{20}\hat{j} m/s$

B. - $\frac{\pi}{20}\hat{i} cm/s$

C. - $\frac{\pi}{20}\hat{j} cm/s$

D. + $\frac{2\pi}{35}\hat{i} cm/s$

Answer: C

Watch Video Solution

PRACTICE SET (EXERCISE-I (LEVEL-II(ADVANCED) MORE THAN ONE CORRECT ANSWER TYPE QUESTIONS))

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

A. wave is travelling along negative x- axis.

B. The speed of the wave is 100 cm/s

C. The frequency wave is $50s^{-1}$

D. The maximum speed of a portion of string is = 3.14 cm/s

Answer: A::C::D

Watch Video Solution

2. Which of the following does not represent a travelling wave

A. $A(ax - bt)$

B. $A\tan(\omega t - kx)$

C. $A\cos^2(vt - x)$

D. y=f (x^2-vt^2)

Answer: A::B::D

Watch Video Solution

3. The equation of a wave is

$$y = 4\sin\left[\frac{\pi}{2}\left(2t + \frac{1}{8}x\right)\right]$$

where y and x are in centimeres and t is in seconds.

A. The amplitude, wavelength, velocity and frequency of wave are $4cm, 16cm, 32cm^{-1}$ and 1Hz respectively with wave propagating along + x direction

B. The amplitude, wavelength, velocity and frequency of wave are 4cm, 32cm, 16cm/s, and 0.5Hz respectively with wave propagating along -x direction

C. Two position occupied by the particle at time interval of 0.4s have a phase difference of 0.4π radian

D. Two position occupied by the particle at separation of 12 cm have a phase difference of 135°

Answer: B::C::D

Watch Video Solution

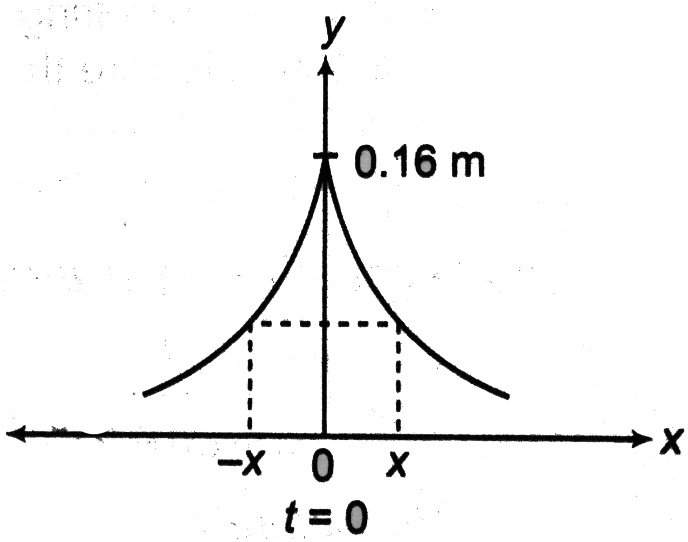
4. $y(x, t) = \frac{0.8}{\left[(4x + 5t)^2 + 5\right]}$ represents a moving pulse where x and y are in metre and t in second. Then,choose the correct alternative(s):

(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



A. pulse is moving in positive x-direction

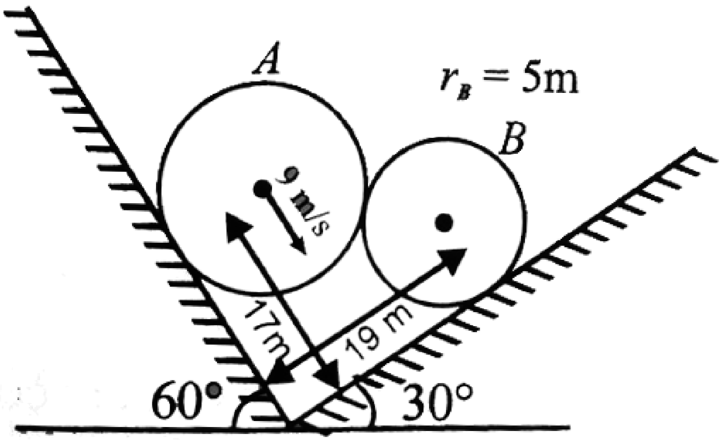
B. in 2 s it will travel a distance of 2.5 m

C. its maximum displacement is 0.16m

D. it is a symmetric pulse

Answer: B::C::D

Watch Video Solution

5. 

System is shown in the figure. Velocity of sphere A is 9 $\frac{m}{s}$. Find the speed of sphere B.

A. $\lambda = 2\pi \times 10^{-2} m$

B. $\lambda = 10^{-3} m$

C. $f = \frac{10^3}{2\pi} Hz$

D. $f = 10^4 Hz$

Answer: A::C::D

Watch Video Solution

6. A wave is represented by the equation :$y = A\sin(10\pi x + 15\pi t + \pi/3)$ where, x is in metre and t is in second. The expression represents.

A. a wave travelling in the positive x-direction with a velocity 1.5m/s

B. a wave travelling in the negative x-direction with a velocity 1.5m/s

C. a wave travelling in the negative x-direction with a wavelength 0.2m

D. a wave travelling in the positive x-direction with a wavelength

0.2m

Answer: B::C

Watch Video Solution

7. A wave eqution which gives the displacement along Y-direction is given by

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

where x and y are in metres and t is time in seconds. This represents a wave

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

B. of wavelength $(\pi)m$

C. of frequency $\left(\frac{30}{\pi}\right)Hz$

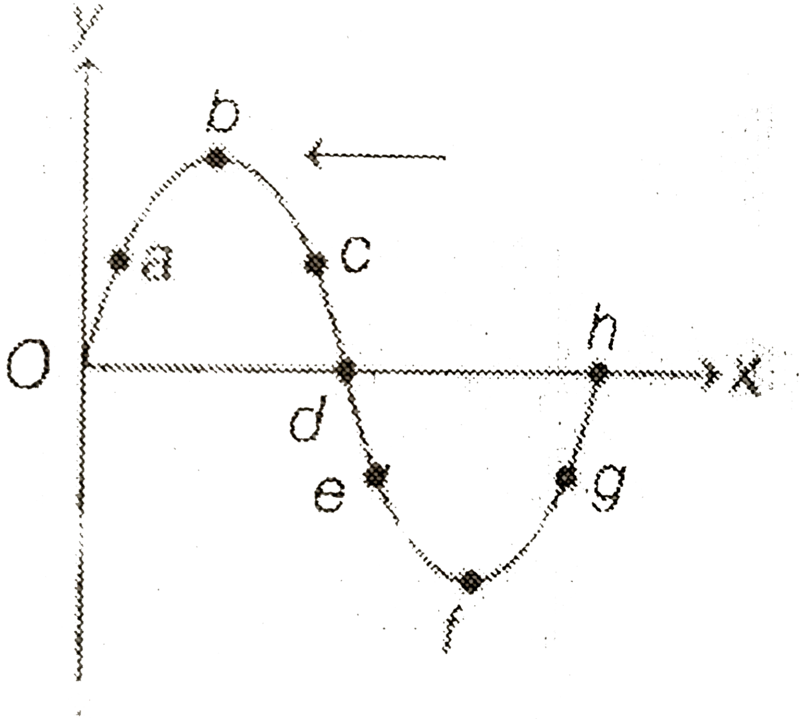
D. of amplitude 10^{-4} m

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

Watch Video Solution

PRACTICE SET (EXERCISE-I (LEVEL-II(ADVANCED) LINKED COMREHENSION TYPE QUESTIONS))

1. 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. d

D. c

Answer: A

Watch Video Solution

2. The figure represents the instantaneous picture of a transverse harmonic wave traveling along the negative x-axis. Choose the correct alternative(s) related to the movement of the nine points shown in the figure.

The points moving downwards is

A. o

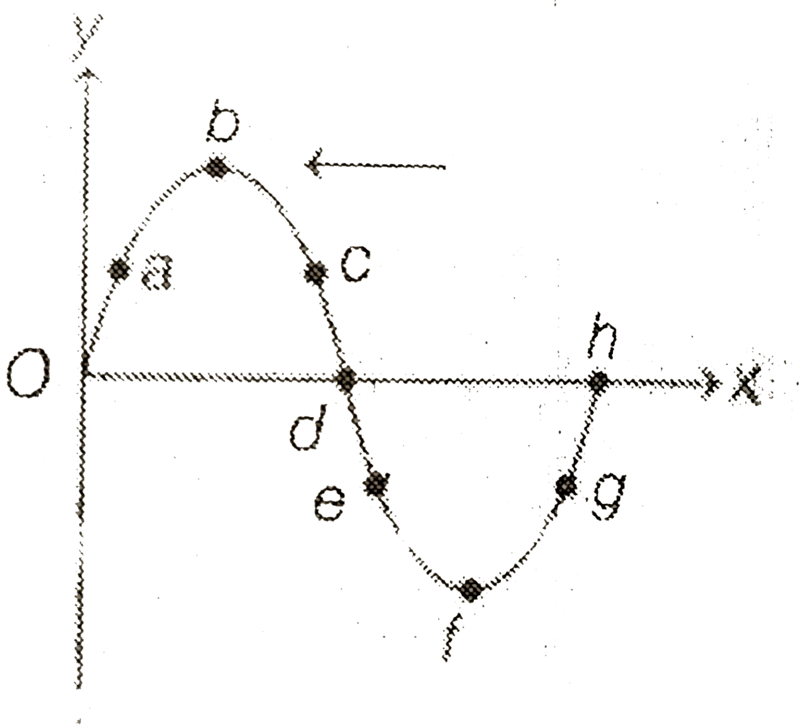
B. b

C. d

D. h

Answer: C

3. 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. o

B. b

C. g

D. h

Answer: B

Watch Video Solution

PRACTICE SET (EXERCISE-I (LEVEL-II(ADVANCED) INTEGER TYPE QUESTIONS))

1. The displacement y of a wave travelling in the x-direction is given by $y = 10^{-4}\sin\left(600t - 2x + \frac{\pi}{3}\right)$ metre. Where, x is expressed in metres and t in seconds. The speed of the wave-motion, in ms^{-1} is

Watch Video Solution

2. A wave travelling along the x-axis is described by the equation $y(x, t) = 0.005\cos(\alpha x - \beta t)$. If the 1wavelength and the time period of the wave are 0.08m and 2.0s, respectively, then $\frac{\alpha}{\beta} = n \times 5$, then the value of n is____(where α, β are in appropriate units).

Watch Video Solution

3. The equation of a wave is $y = 4\sin\left\{\frac{\pi}{2}\left(2t + \frac{x}{8}\right)\right\}$ where y , x are in cm and time in seconds. The phase difference between two position of the same particle which are occupied at time interval of 0.4 s is $x\pi \times 10^{-1}$, what is the value of x ?

Watch Video Solution

PRACTICE SET (EXERCISE-II (LEVEL-I(MAIN) STRAIGHT OBJECTIVE TYPE QUESTIONS))

1. A transverse wave propagating on a stretched string of linear density $3 \times 10^{-4} kg - m^{-1}$ is represented by the equation

$y = 0.2\sin(1.5x + 60t)$

Where x is in metre and t is in second. The tension in the string (in Newton) is

A. 0.24

B. 0.48

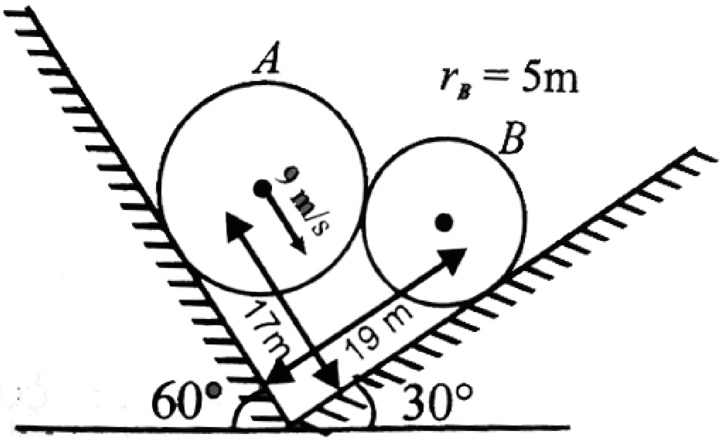
C. 1.2

D. 1.8

Answer: B

Watch Video Solution

2.



System is shown in the figure. Velocity of sphere A is 9 $\frac{m}{s}$. Find the speed of sphere B.

A. $\frac{M}{M+m}$

B. $\sqrt{\frac{M}{M+m}}$

C. $\frac{M+m}{M}$

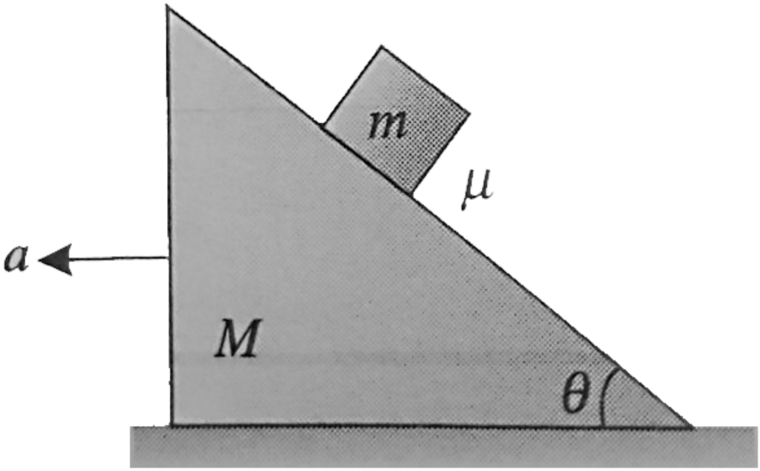
D. $\sqrt{\frac{M+m}{M}}$

Answer: B

Watch Video Solution

3. the ratio of the wavelengths of alpha line of lyman series in H atom and beta line of balmer series in he+ is

Watch Video Solution



4. .

A block of mass m is at rest relative to the stationary wedge of mass M. The coefficient of friction between block and wedge is μ. The wedge is now pulled horizontally with acceleration a as shown in figure. Then the minimum magnitude of a for the friction between block and wedge to be zero is:

A. $\frac{M}{M+m}$

B. $\sqrt{\frac{M}{M+m}}$

C. 1

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

Answer: C

Watch Video Solution

PRACTICE SET (EXERCISE-II (LEVEL-II(ADVANCED) STRAIGHT OBJECTIVE TYPE QUESTIONS))

1. A string of length L consists of two distinct sections. The left half has linear mass density $\mu_1 = \mu_0/2$ while the right half has linear mass density $\mu_2 = 3\mu_0$. Tension in the string is F_0 . The time required for a transverse wave pulse to travel from one end of the string to the other is

A. $L.4\sqrt{\frac{\mu_0}{F_0}}\left(\sqrt{2}+\sqrt{6}\right)$

B. $\frac{L}{2}\sqrt{\frac{2\mu_0}{F_0}}\left(1+\sqrt{3}\right)$

C. $\frac{L}{2}\sqrt{\frac{\mu_0}{2F_0}}\left(\sqrt{2}+\sqrt{6}\right)$

D. $\frac{L}{2}\sqrt{\frac{\mu_0}{2F_0}}\left(1+\sqrt{6}\right)$

Answer: D

Watch Video Solution

2. A transverse wave is tranvelling in a string at any moment a small element 'dx' is at inclination 30° with the direction of propagation of the wave. After some time interval its inclination changes to 60° with direction of propagation. Potential energy of this small element is initially U_0 and finally it is KU_0, value of K is

A. 2

B. 9

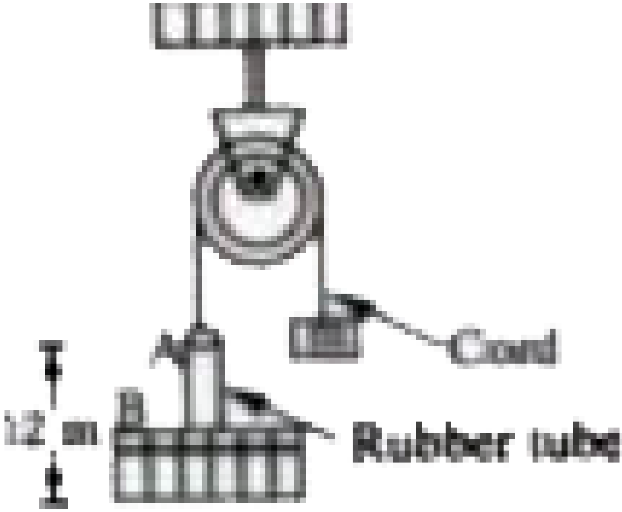
C. 3

D. 4

Answer: B

Watch Video Solution

3. A long rubber tube having mass 0.9kg is fastened to a fixed support and the free end of the tube is attached to a cord which passase over a pulley and supports an object, with a mass of 5 kg as shown in fig. If the tube is struck by a transvers blow at one end, the time required for the pulse to reach the 49 other end is (linear density of tube $= \frac{49}{625} kg/m$)



A. 5s

B. 0.47s

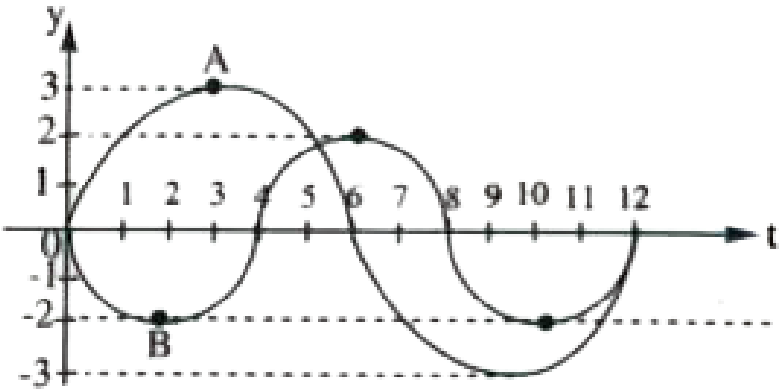
C. 4.7s

D. 3.2s

Answer: B

Watch Video Solution

4. The transversal displacement V_s time graph for two waves A and B which travel along the same string are shown in the figure. Their average intensity ratio I_A/I_B is



A. $\frac{9}{4}$

B. 1

C. $\frac{81}{16}$

D. $\frac{3}{2}$

Answer: B

Watch Video Solution

5. Two harmonic waves travelling in the same medium have frequency in the ratio 1:2 and intensity in the ratio 1:36. Their amplitude ratio is

(a) $1:6$

(b) $1:8$

(c) $1:72$

(d) $1:3$

A. $1:6$

B. $1:8$

C. $1:72$

D. $1:3$

Answer: D

Watch Video Solution

6. The ratio of densities of nitrogen and oxygen is 14 : 16. The temperature at which the speed of sound in nitrogen will be same as that in oxygen at $55^{\circ} C$ is

A. $35^{\circ} C$

B. $48^{\circ} C$

C. $65^{\circ} C$

D. $14^{\circ} C$

Answer: D

Watch Video Solution

7. A tuning fork produces a wave of wavelength 110 cm in air at $O^{0}C$. The wavelength at $25^{\circ} C$ would be

A. 110 cm

B. 115 cm

C. 120 cm

D. 130 cm

Answer: B

Watch Video Solution

8. A road runs midway between two parallel rows of buildings. A motorist moving with a speed of 36 Km/h sounds the horn. He hears the echo one second after he has sounded the horn: Then the distance between the two rows of buildings is. (Velocity of sound in air is 330 m/s)

A. $80\sqrt{17}m$

B. $40\sqrt{17}m$

C. $30\sqrt{10}m$

D. $330m$

Answer: A

Watch Video Solution

9. A mixture of two diatomic gases exists in a closed cylinder. The volumes and velocities of sound in the two gases are V_1, V_2, c_1 and c_2 respectively. Determine the velocity of sound in the gaseous mixture. (Pressure of gas remains constant),

A. $c = \sqrt{\dfrac{m_1c_2^2 - m_2c_1^2}{m_2 + m_1}}$

B. $c = \sqrt{\dfrac{m_1c_2^2 + m_2c_1^2}{m_1 + m_2}}$

C. $c = \sqrt{\dfrac{m_1c_1^2 + m_2c_2^2}{m_1 + m_2}}$

D. $c = \sqrt{\dfrac{m_1c_2^2 + m_2c_1^2}{m_1 - m_2}}$

Answer: C

Watch Video Solution

10. The density of NH_3 at 30^oC and 5 atm pressure is:

A. $4.98N/m^2$

B. $6.98N/m^2$

C. $2.98N/m^2$

D. $1.98N/m^2$

Answer: A

Watch Video Solution

11. A sound wave is passing through air column in the form of compression and rarefaction. In consecutive compressions and rarefactions,

A. P_c is maximum and P_r is minimum.

B. P_c is minimum and P_r is maximum

C. the pressure amplitude is Bak

D. if the displacement wåve is $Y = a\sin(\omega t - kx)$, the pressure wave at an instant is represented as $\frac{P_c - P_r}{2}\cos(\omega t - kx)$ which leads displacement wave by a phase angle of $\pi/2$

Answer: A::C::D

Watch Video Solution

12. A source is moving across a circle given by the equation $x^2 + y^2 = R^2$ with constant speed $v_S = \frac{330\pi}{6\sqrt{3}} m/s$. In clockwise sense. A detector is stationary at the point $(2R, 0) w.r.t.$ the centre of the circle. The frequency emitted by the source is f_S.

(a) What are the co-ordinates of the source when the detector records the maximum and minimum frequencies. Take speed of sound $v = 330 m/s$.

A. The position of the source when the detector records the maximum frequency $\left(+\frac{\sqrt{3}}{2}R, -\frac{R}{2}\right)$

B. The co-ordinate of the source when the detector records maximum frequency is (0, R)

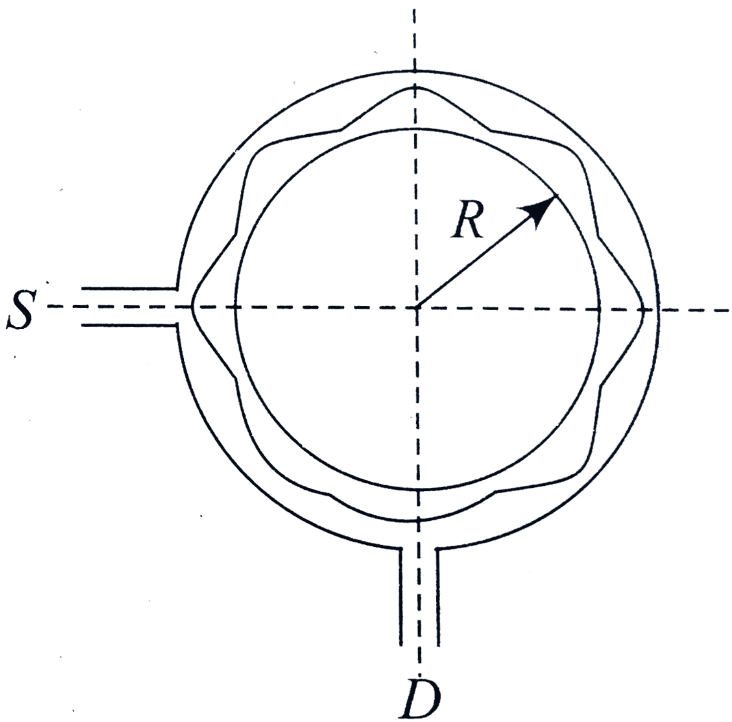
C. The maximum frequency recorded by the detector is $\frac{6\sqrt{3}}{\pi + 6\sqrt{3}}f$

D. The minimum frequency recorded by the detector is $\frac{6\sqrt{3}}{6\sqrt{3} - \pi}f$

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

Watch Video Solution

13. A narrow tube is bent in the form of a circle of radius R, as shown in figure. Two small holes S and D are made in the tube at the position at right angle to each other. A source placed at S generates a wave of intensity I_0 which two parts: one part travels along the longer path, while the other travels along the shorter path. Both the waves meet at point D where a detector is placed.



The maximum intensity produced at D is given by

A. $4I_0$

B. $2I_0$

C. I_0

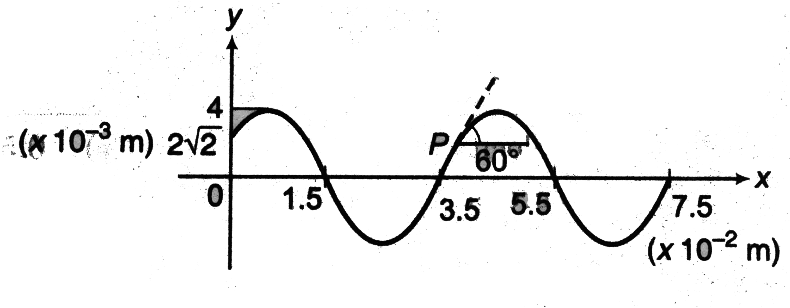
D. $3I_0$

Answer: B

Watch Video Solution

PRACTICE SET (EXERCISE-II (LEVEL-II(ADVANCED) MORE THAN ONE CORRECT ANSWER TYPE QUESTIONS))

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 $50 g/m$.

A. wave is moving along positive x-direction

B. The equation of the wave is y = 0.4 $\sin\left(10\pi t - \frac{\pi}{2}x\right)$

C. Total energy carried by the wave per cycle of the string is

$1.6 \times 10^{-5} J$

D. The equation of the wave is $y = 4mm\sin\left(10\pi\frac{\pi}{2}x + \frac{\pi}{4}\right)$

Answer: C::D

Watch Video Solution

2. A simple harmonic wave has the equation $y_1 = 0.3\sin(314t - 1.57x)$ and another wave has equation $y_2 = 0.1\sin(314t - 1.57x + 1.57)$ where x, y_1 and y_2 are in metre and t is in second.

A. $v_1 = v_2 = 50Hz$

B. $\lambda_1 = \lambda_2 = 4m$

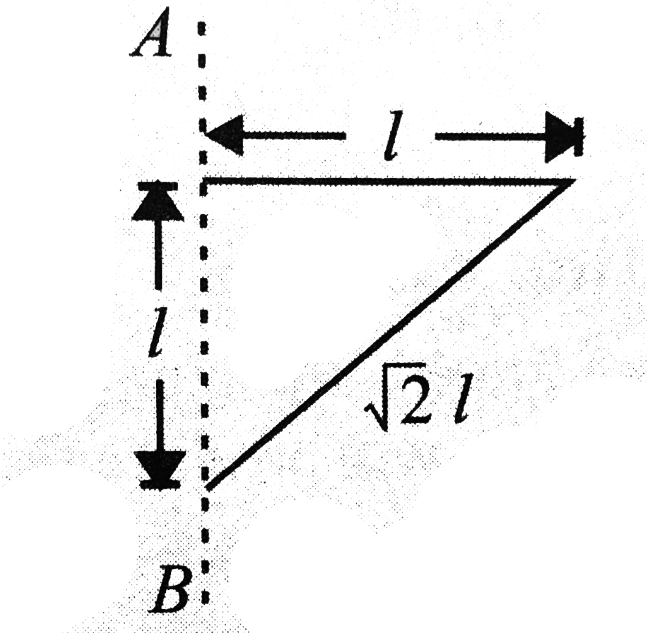
C. Ratio of intensity is 9

D. y_2 leads y_1 by a phase angle of $\frac{\pi}{2}$

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

Watch Video Solution

3. Find MI of a triangular lamina of mass M about the axis of rotation AB shown in Fig.



A. The speed of the transverse pulse just after generated at the free end point P with respect to ground is $l\omega$

B. The speed of the transverse pulse when it reaches the mid point of string with respect to ground is $\frac{\sqrt{5}l\omega}{\sqrt{8}}$

C. The tension in the string at a distance 'x' from the free and $\frac{\mu\left[L^2 - (L - x)^2\right]}{2}\omega^2$

D. The time taken by the transverse pulse to reach the axis of rotation from free end is $\frac{\pi}{\sqrt{2}\omega}$

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

Watch Video Solution

4. Consider a harmonic wave travelling on a string of mass per unit length mu. The wave has a velocity v, amplitude A and frequency if. The power transmitted by a harmonic wave on the string is proportional to (take constant of proportionality as $2\pi^2$)

A. μ

B. v

C. A^2

D. f^2

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

Watch Video Solution

PRACTICE SET (EXERCISE-II (LEVEL-II(ADVANCED) LINKED COMPREHENSION TYPE QUESTIONS))

1. One end of a 60m long rope of mass 1.8 kg is tied to a rigid horizontal support held high above the ground. The rope hangs vertically and kept taut by a weight 'W' suspended at its lower end. A person jerks the lower end of the rope sideways in a sinusoidal manner and a transverse wave of frequency 2 Hz and amplitude 10cm passes along the rope such that there are 2 cycles of the wave in the total length of the rope. Neglecting the weight of the rope as compared to the suspended weight W and with g = 10m/s2, answer the following questions. $\left(S = 75 \times 10^{-4} m^2\right)$

In the questions above, weight of the rope has been neglected as compared to the suspended weight. However, if we also account for the weight of the rope. the speed of the wave at the top of the rope will be

A. 3.2w

B. 2.25w

C. 1.4w

D. 0.75w

Answer: A

Watch Video Solution

2. One end of a 60m long rope of mass 1.8 kg is tied to a rigid horizontal support held high above the ground. The rope hangs vertically and kept taut by a weight 'W' suspended at its lower end. A person jerks the lower end of the rope sideways in a sinusoidal manner and a transverse wave of frequency 2 Hz and amplitude 10cm passes along the rope such that there are 2 cycles of the wave in the total length of the rope. Neglecting the weight of the rope as compared to the suspended weight W and with g = 10m/s2, answer the following questions. $\left(S = 75 \times 10^{-4} m^2\right)$

In the questions above, weight of the rope has been neglected as compared to the suspended weight. However, if we also account for the weight of the rope. the speed of the wave at the top of the rope will be

A. 60m/s

B. 64.8m/s

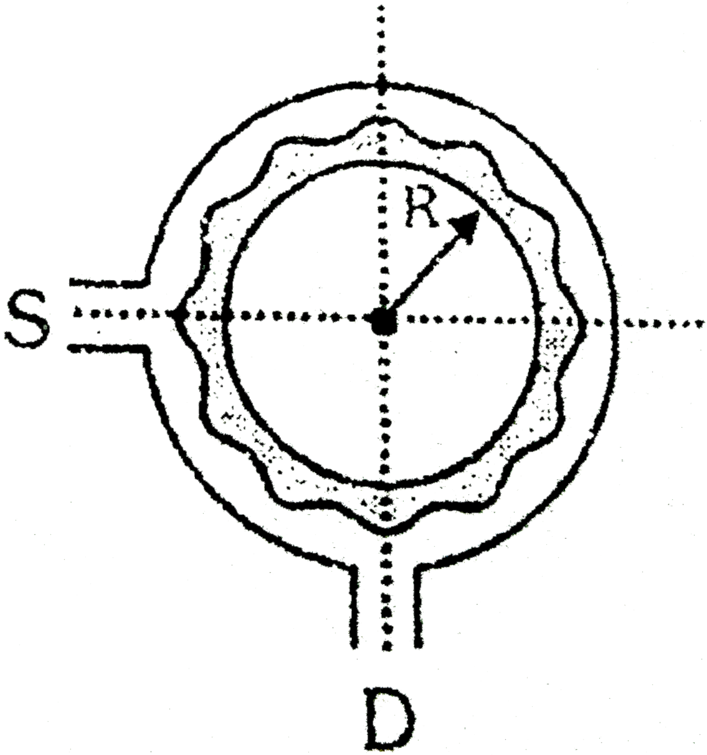
C. 62.6m/s

D. 68.4m/s

Answer: B

Watch Video Solution

3. A narrow tube is bend in the form of a circle of radius R, as shown in the figure. Two small holes S and D are made in the tube at the positions right angle to each other. A source placed at S generated a wave of intensity I_0 which is equally divided into two parts : One part travels along the longer path, while the other travels along the shorter path. Both the parts wave meet at the point D where a detector is placed.



The maximum value of λ to produce a maxima at D is given by :-

A. πR

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

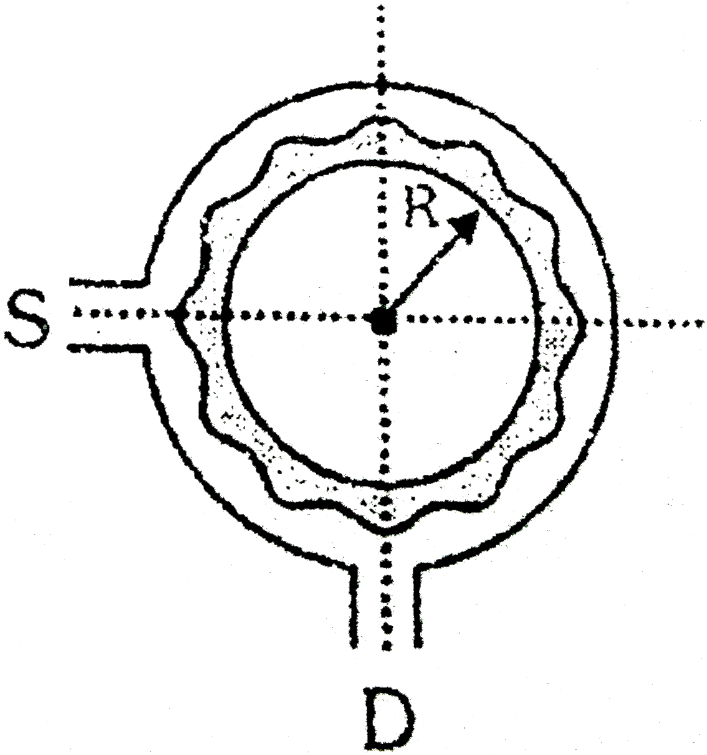
C. $\frac{\pi R}{4}$

D. All of these

Answer: D

Watch Video Solution

4. A narrow tube is bend in the form of a circle of radius R, as shown in the figure. Two small holes S and D are made in the tube at the positions right angle to each other. A source placed at S generated a wave of intensity I_0 which is equally divided into two parts : One part travels along the longer path, while the other travels along the shorter path. Both the parts wave meet at the point D where a detector is placed.



The maximum value of λ to produce a maxima at D is given by :-

A. $2\pi R$

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

C. $\frac{2}{5}\pi R$

D. none of these

Answer: C

Watch Video Solution

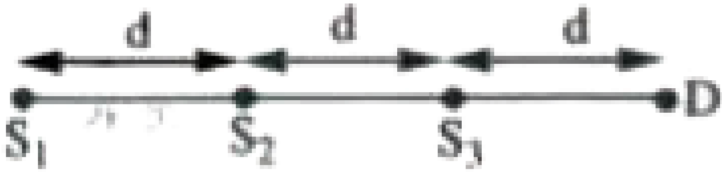
PRACTICE SET (EXERCISE-II (LEVEL-II(ADVANCED) INTEGER TYPE QUESTIONS))

1. A copper wire is held at the two ends by rigid supports. At $60\,^{\circ}C$, the wire is just taut with negligible tension. The speed of transverse waves in this wire at $10\,^{\circ}C$ is $x \times 10^{1}$ m/s, what is the value of x.

$\left(y = 1.6 \times 10^{11} N/m^{2}, \alpha = 1.8 \times 10^{-6}/\,^{\circ}C \text{ and } \rho = 9 \times 10^{3} kg/m^{3}\right)$

Watch Video Solution

2. Three coherent sources generating waves in the same phase are placed as shown. The wave length of the wave is 40×10^{-7} m. The minimum distanced (in μ m), such that intensity at point D is 9 times the intensity of each source will be ......



Watch Video Solution

PRACTICE SET (EXERCISE-III (LEVEL-I(MAIN) STRAIGHT OBJECTIVE TYPE QUESTIONS))

1. The length of a sonometer wire tuned to a frequency of 256 Hz is 0.6 m. Calculate the frequency of the tuning fork with which the vibrating wire will be in tune when the length is made 0.4 m

A. 78Hz

B. 512Hz

C. 384Hz

D. 126Hz

Answer: C

Watch Video Solution

2. The fundamental frequency of a string stretched with a weight of 4 kg is 256 Hz. The weight required to produce its octave is

A. 4 kg wt

B. 12 kg wt

C. 16 kg wt

D. 24 kg wt

Answer: C

Watch Video Solution

3. A wire having a linear mass density $5.0 \times 10^{-3} kg/m$ is stretched between two rigid supports with a tension of 450 N. The wire resonates at a frequency of 420 Hz. The next higher frequency at which the same wire resonates is 490 Hz. Find the length of the wire.

A. 1.2m

B. 1.8m

C. 2.1m

D. 8.1m

Answer: C

Watch Video Solution

4. In order to double the frequnecy of the fundamental note emitted by a stratched string the length is reduced to $\frac{3}{4}$ th of the original length and the tension is changed. The factor by which the tension is to be changed is

A. $\frac{3}{8}$

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

C. $\frac{8}{9}$

D. $\frac{9}{4}$

Answer: D

Watch Video Solution

5. 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. $2:1$

C. $1:\sqrt{2}$

D. $\sqrt{2}:1$

Answer: D

Watch Video Solution

6. Two uniform strings A and B made of steel are made to vibrate under the same tension. If the first overtone of A is equal to the second overtone of B and if the radius of A is twice that of B, the ratio of the lengths of the strings is

A. $1:2$

B. $1:3$

C. $1:4$

D. $1:5$

Answer: B

Watch Video Solution

7. Does the escape speed of a body from the earth depend on.

(i)mass of the body

(ii)the location from where it is projected

(iii)the direction of projection

(iv)the height of the location from where the body is launched?

A. 40m/s

B. 20m/s

C. 10m/s

D. 5m/s

Answer: B

Watch Video Solution

8. Two strings of the same material and the same area of cross-section are used in sonometer experiment. One is loaded with 12kg and the other with 3 kg. The fundamental frequency of the first string is equal to the first overtone of the second string. If the length of the second string is 100 cm, then the length of the first string is

A. 300cm

B. 200cm

C. 100cm

D. 50cm

Answer: C

Watch Video Solution

9. The equation of a stationary wave is $y = 0.8\cos\left(\frac{\pi x}{20}\right)\sin 200\pi t$ where x is in cm and t is in s. The separation between consecutive nodes will be

A. 7.5, 12.5

B. 2.5, 7.5

C. 12.5, 17.5

D. 5, 10

Answer: A

Watch Video Solution

10. Two transverse waves A and B superimposed to produce a node at x = 0. If the equation of wave A si $y = a\cos(kx - \omega t)$, then the equation of wave B is

A. y = a sin (wt+kx)

B. y = a cos (kx-wt)

C. y = -a cos (kx-wt)

D. y = -a sin (kx+wt)

Answer: D

Watch Video Solution

PRACTICE SET (EXERCISE-III (LEVEL-II(ADVANCED) STRAIGHT OBJECTIVE TYPE QUESTIONS))

1. A composition string is made up by joining two strings of different masses per unit length 1g/ m and 4 g/m. The composite string is under the same tension. A transverse wave pulse : Y = (6 mm) sin(5t + 40x), where it is in seconds and 'x' in meters, is sent along the lighter string towards the joint. The joint is at x = 0. The equation of the wave pulse reflected from the joint is

A. (2 mm) sin(5t – 40x)

B. (4 mm) sin(40x - 5t)

C. -(2 mm) sin(5t – 40x)

D. (2 mm) sin (5t - 10x)

Answer: C

Watch Video Solution

2. A stiff wire is bent into a cylinder loop of diameter D. It is clamped by knife edges at two points opposite to each other . A transverse wave is sent around the loop by means resonance frequency (fundamental mode) of the loop in terms of wave speed v and diameter D is

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

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

C. $\frac{v}{\pi D}$

D. $\frac{v}{2\pi D}$

Answer: C

Watch Video Solution

3. 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

Watch Video Solution

4. Find the tension needed to produce stationary waves with 4 loops in a string 1m long and 0.5 gram in weight, fixed to a tuning fork of frequency 200Hz, when the prongs of the fork are vibrating perpendicular to the string.

A. 5N

B. 10N

C. 15N

D. 0.5N

Answer: A

Watch Video Solution

5. The fundamental frequency of a sonometer wire increases by $6Hz$ if its tension is increased by 44% , keeping the length constant . Find the change in the fundamental frequency of the sonometer wire when the length of the wire is increased by 20% , keeping the original tension in the wire constant.

A. 4Hz

B. 7Hz

C. 5Hz

D. 3Hz

Answer: C

Watch Video Solution

6. As a charged particle 'q' moving with a velocity $\vec{v}$ enters a uniform magnetic field $\vec{B}$, it experience a force $\vec{F} = q\left(\vec{v} \times \vec{B}\right)$. F or $\theta = 0^\circ$ or 180°, θ being the angle between $\vec{v}$ and $\vec{B}$, force experienced is zero and the particle passes undeflected. For $\theta = 90^\circ$, the particle moves along a circular arc and the magnetic force (qvB) provides the necessary centripetal force $\left(mv^2/r\right)$. For other values of $\theta\left(\theta \neq 0^\circ, 180^\circ, 90^\circ\right)$, the charged particle moves along a helical path which is the resultant motion of simultaneous circular and translational motions.

Suppose a particle that carries a charge of magnitude q and has a mass 4×10^{-15} kg is moving in a region containing a uniform magnetic field $\vec{B} = -0.4\hat{k}T$. At some instant, velocity of the particle is $\vec{v} = \left(8\hat{i} - 6\hat{j}4\hat{k}\right) \times 10^6 ms^{-1}$ and force acting on it has a magnitude 1.6 N

Angular frequency of rotation of particle, also called the `cyclotron frequency' is

A. 25Hz

B. 35Hz

C. 15Hz

D. 45Hz

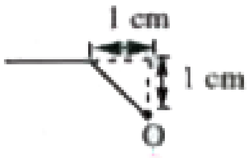
Answer: B

Watch Video Solution

7. 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

Watch Video Solution

PRACTICE SET (EXERCISE-III (LEVEL-II(ADVANCED) MORE THAN ONE CORRECT ANSWER TYPE QUESTIONS))

1. Two wires of different densities are soldered together end to end then stretched under tension T. The waves speed in the first wire is twice that in the second wire.

(a) If the amplitude of incident wave is A, what are amplitudes of reflected and transmitted waves?

(b) Assuming no energy loss in the wire, find the fraction of the incident power that is reflected at the junction and fraction of the same that is transmitted.

A. $y_r = A_r \sin(\omega t + k_1 x)$

B. $y_t = A_t \sin(\omega t - k_2 x)$

C. $A_r = \left(\frac{k_1 - k_2}{k_1 + k_2}\right) A_i$

D. $A_t = \left(\frac{2k_1}{k_1 + k_2}\right) A_i$

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

Watch Video Solution

2. Two waves of nearly same amplitude , same frequency travelling with same velocity are superimposing to give phenomenon of interference . If a_1 and a_2 be their respectively amplitudes , ω be the frequency for both , v be the velocity for both and $\Delta\phi$ is the phase difference between the two waves then ,

A. the resultant intensity varies periodically with time and distance.

B. the resultant intensity with $\frac{I_{min}}{I_{max}} = \left(\frac{a_1 - a_2}{a_1 + a_2}\right)^2$ is obtained

C. both the waves must have been travelling in the same direction and must be coherent.

D. $I_s = I_1 + I_2 + 2\sqrt{I_1 I_2}\cos(\Delta\pi)$ where constuctive interference is obtained for path differences that are even multiple of $\frac{1}{2}\lambda$ and destructive interference is obtained for path differences that are odd multiple $\frac{1}{2}\lambda$

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

Watch Video Solution

3. Along the straight line joining two consecutive displacement nodes in a pure stationary sound wave at different points

A. the S.H.M's will be in different phases

B. Velocities are in phase

C. the accelerations are in phase

D. frequencies are equal

Answer: B::C::D

Watch Video Solution

4. A wire of density $9 \times 10^3 kg/m^3$ is stretched between two clamps 1 m apart and is stretched to an extension of 4.9×10^{-4} metre.Young's modulus of material is $9 \times 10^{10} N/m^2$.Then

A. The lowest frequency of standing wave is 35 Hz

B. The frequency of 1st overtone is 70Hz

C. The frequency of 1st overtone is 105 Hz

D. The lowest frequency of standing wave is 70Hz

Answer: A::B

Watch Video Solution

5. In which case is the power being delivered by a given progressive sinusoidal wave on a given string is doubled? Material of the string is unchanged.

A. The wave amplitude is doubled (keeping the frequency the same).

B. The wave frequency is cut in half (keeping the amplitude the same).

C. Tension in the string is made four times the initial value (keeping its linear density, amplitude and frequency the same).

D. The diameter of the string is doubled (keeping the tension amplitude and frequency the same).

Answer: C::D

Watch Video Solution

PRACTICE SET (EXERCISE-III (LEVEL-II(ADVANCED) LINKED COMPREHENSION TYPE QUESTIONS))

1. A string vibrates according to the equation $y = 5\sin\frac{\pi x}{3}\cos 40\pi t$ where, x and y are in centimeters and t is in seconds.

(a) What is the speed of the component wave?

(b) What is the distance between the adjacent nodes?

(c) What is the velocity of the particle of the string at the position $x = 1.5$ cm when $t = \frac{9}{8}s$?

A. $2.5cm, 1.2ms^{-1}$

B. $1cm, 2.5ms^{-1}$

C. $1.5cm, 2.5ms^{-1}$

D. $2cm, 3.5ms^{-1}$

Answer: A

Watch Video Solution

2. A stationary wave is given by $y = 5\frac{\sin(\pi x)}{3}\cos 40\pi t$ where x and y are in cm and t is in seconds

What is the distance between two successive nodes

A. 0.01m

B. 0.02m

C. 0.03m

D. 0.04m

Answer: C

Watch Video Solution

3. A stationary wave is given by $y = 5\frac{\sin(\pi x)}{3}\cos 40\pi t$ where x and y are in cm and t is in seconds

What is the velocity of a particle of the string at the position x = 1.5 cm when $t = \frac{9}{8}s$

A. 0

B. $1ms^{-1}$

C. $2ms^{-1}$

D. $3ms^{-1}$

Answer: A

Watch Video Solution

PRACTICE SET (EXERCISE-III (LEVEL-II(ADVANCED) MATRIX MATCHING TYPE QUESTIONS))

1. A wave disturbance in a medium is described by $Y = 0.02\cos\left(50\pi t + \frac{\pi}{2}\right)\cos\pi x$. Where x and y are in m and t in sec.

The values in Column-II are in SI units.

Column - I	Column - II
A) Node occurs at	p) 0.5 m
B) Antinode occurs at	q) 50 m/s
C) speed of wave	r) 2 m
D) wave length	s) 1 m

Watch Video Solution

PRACTICE SET (EXERCISE-III (LEVEL-II(ADVANCED) INTEGER TYPE QUESTIONS))

1. A stretched string is taken and stretched such that elongated by 1% then the fundamental frequency decreased by $x \times 10^{-1}\%$ what is the value of x ?

Watch Video Solution

2. A somoneter wire resonates with a given tuning fork forming standing waves with five antindoes between the two bridges when a mass of 9 kg is suspended from the wire. Resonates with the same tuning fork forming three antindoes for the same postions of the bridges. the value of M is

Watch Video Solution

PRACTICE SET (EXERCISE-IV (LEVEL-I(MAIN) STRAIGHT OBJECTIVE TYPE QUESTIONS))

1. The elecron is a hydrogen atoms makes a transition $n_1 \to n_2$ where n_1 and n_2 are the principal quantum numbers of two states. Assume the Bohr model to be be valid. The time period of the electron in the initial state is eight times of the final state. Teh possible values of n_1 and n_2 are

A. $\sqrt{2/7}$

B. $\sqrt{1/7}$

C. $\sqrt{3}/5$

D. $\sqrt{6}/5$

Answer: C

Watch Video Solution

2. The velocities of sound in an ideal gas at temperature T_1 and T_2 K are found to be V_1 and V_2 respectively. If ther.m.s velocities of the molecules of the same gas at the same temperatures T_1 and T_2 are v_1 and v_2 respectively then

A. $v_2 = v_1\left(\frac{V_1}{V_2}\right)$

B. $v_2 = v_1\left(\frac{V_2}{V_1}\right)$

C. $v_2 = v_1\sqrt{\frac{V_2}{V_1}}$

D. $v_2 = v_1\sqrt{\frac{V_1}{V_2}}$

Answer: B

Watch Video Solution

3. The speed of sound in oxygen $\left(O_2\right)$ at a certain temperature is $460ms^{-1}$. The speed of sound in helium (He) at the same temperature will be (assumed both gases to be ideal)

A. $1420ms^{-1}$

B. $500ms^{-1}$

C. $650ms^{-1}$

D. $330ms^{-1}$

Answer: A

Watch Video Solution

4. A man standing at some distance from a cliff hears the echo of sound after 2s. He walks 495 m away from the cliff. He produces a sound there and receives the echo after 5s. What is the speed of sound?

A. 330 m/s

B. 340 m/s

C. 390 m/s

D. 380 m/s

Answer: A

Watch Video Solution

5. 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

6. At room temperature, a dilute solution of urea is prepared by dissolving 0.60 g of urea in 360 g of water. If the vapour pressure of pure water at this temperature is 35 mm Hg, lowering of vapour pressure will be 1.74×10^{-x} mm Hg. The numerical value of x is ___________. (Molar mass of urea = 60 g mol^{-1}).

A. 10

B. $\sqrt{10}$

C. 10^{-6}

D. 10^{-2}

Answer: B

Watch Video Solution

7. A window whose area is $2m^2$ opens on street where the street noise result in an intensity level at the window of 60 dB. How much acoustic power enters the window via sound waves. Now if an acoustic absorber is fitted at the window, how much energy from street will it collect in 5 h?

A. $26 \times 10^{-13} J$

B. $26 \times 10^{-10} J$

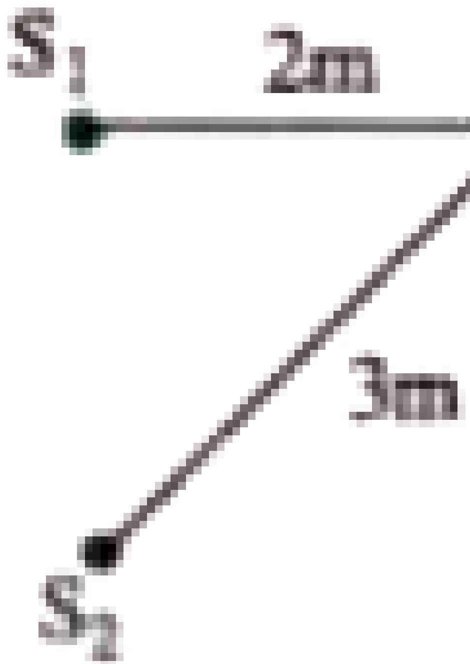
C. $36 \times 10^{-3} J$

D. $46 \times 10^{-10} J$

Answer: C

Watch Video Solution

8. Two identical speakers emit sound waves of frequency 660Hz uniformly in all directions. The audio output of each speaker is 1mW and the speed of sound in air. A point P is a distance 2m from one speaker and 3m from the other. If they are driven coherently but out of phase by $180°$, the intensity at the point 'P' is



A. $55.3 \mu W / m^2$

B. $2.2 \mu W / m^2$

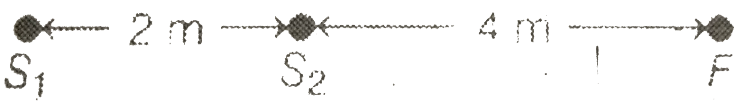
C. $28.7 \mu W / m^2$

D. $28.7 \mu W / m^2$

Answer: B

Watch Video Solution

9. S_1 and S_2 are two sources of sound etmitting sine waves. The two sources are in phase. The sound emitted by the two sources interfere at point F. The waves of wavelength



A. 1m will result in constructive interference

B. 2/3 m will result in constructive interference

C. 2m will result in destructive interference

D. 4m will result in destructive interference

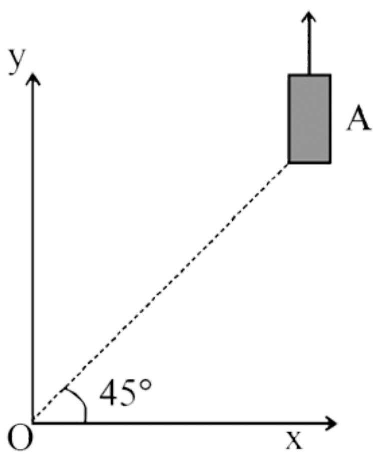
Answer: C

Watch Video Solution

10. On a frictionless horizontal surface , assumed to be the x - y plane , a small trolley A is moving along a straight line parallel to the y - axis (see figure) with a constant velocity of $(\sqrt{3} - 1)m/s$. At a particular instant , when the line OA makes an angle of $45(\circ)$ with the x - axis , a ball is thrown along the surface from the origin O. Its velocity makes an angle ϕ with the x - axis and it hits the trolley .

(a) The motion of the ball is observed from the frame of the trolley . Calculate the angle θ made by the velocity vector of the ball with the x - axis in this frame .

(b) Find the speed of the ball with respect to the surface , if $\phi = (4\theta)/(3)$.



A. $330ms^{-1}$

B. $360ms^{-1}$

C. $350ms^{-1}$

D. $340ms^{-1}$

Answer: B

Watch Video Solution

PRACTICE SET (EXERCISE-II (LEVEL-II(ADVANCED) MATRIX MATCHING TYPE QUESTIONS))

1. A wave disturbance in a medium is described by $Y = 0.02\cos\left(50\pi t + \frac{\pi}{2}\right)\cos\pi x$. Where x and y are in m and t in sec.

The values in Column-II are in SI units.

Column - I	Column - II
A) Node occurs at	p) 0.5 m
B) Antinode occurs at	q) 50 m/s
C) speed of wave	r) 2 m
D) wave length	s) 1 m

Watch Video Solution

PRACTICE SET (EXERCISE-V (LEVEL-I(MAIN) STRAIGHT OBJECTIVE TYPE QUESTIONS))

1. An organ pipe P_1 closed at one end and vibrating in its first overtone, and another pipe P_2 open at both ends and vibrating in its third overtone, are in resonance with a given tuning fork. The ratio of the length of P_1 to that of P_2 is

A. $\frac{8}{3}$

B. $\frac{3}{8}$

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

D. $\frac{1}{3}$

Answer: B

Watch Video Solution

2. If I_1, I_2 and I_3 are wave lengths of the waves giving resonance with fundamental, first and second over tones of closed organ pipe. The ratio of wavelengths $I_1 : I_2 : I_3$ 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

3. If a resonance tube is sounded with a tuning fork of frequency 256 Hz, resonance occurs at 35 cm and 105 cm. The velocity of sound is about

A. 360 m/s

B. 512 m/s

C. 524 m/s

D. 400 m/s

Answer: A

Watch Video Solution

4. Electron exicted from lower orbit to higher orbit and returns back to ground state from excited state with a life time1 nanosecond by emitting a photon of wave length 600nm. Calculate uncertainity in the energy of the excited state. Also calculate the percentage uncertainity, if the energy is measured from ground state.

A. $18 > x$

B. $x > 54$

C. $54 > x > 36$

D. $36 > x > 18$

Answer: B

Watch Video Solution

5.

- $\frac{VX}{4l^2}$
- $\frac{Vl^2}{2X}$
- $\frac{VX}{2l^2}$

- $\frac{VX^2}{2l}$

Answer: C

Watch Video Solution

6. Two sounding bodies are producing progressive waves given by $y_1 = 4\sin(400\pi t)$and $y_2 = 3\sin(404\pi t)$, where t is in second which superpose near the ears of a person. The person will hear

A. 2 and 5/1

B. 4 and 49/1

C. 4 and 16/9

D. 2 and 49/1

Answer: D

Watch Video Solution

7. Two stretched wires of same length, diameter and same material are in unison. The tension in one is increased by 2% and 2 beats per second are heard. What was the frequency of the note produced when they were in unison

A. 100 Hz

B. 200 Hz

C. 300 Hz

D. 400 Hz

Answer: B

Watch Video Solution

8. 64 tuning forks are arranged such that each fork produces 4 beats per second with next one. If the frequency of the last fork is octave of the first, the frequency of 16th fork is

A. 316 Hz

B. 322 Hz

C. 312 Hz

D. 314 Hz

Answer: C

Watch Video Solution

9. Chemical reactions are invariably associated with the transfter of energy either in the form of heat or light. In the laboratory, heat changes in physical and chemical processes are measured with an instrument called calorimeter. Heat change in the process is calculated as

$$\begin{aligned} q &= ms\Delta T \qquad s = \text{Specific heat} \\ &= c\Delta T \qquad c = \text{Heat capacity} \end{aligned}$$

Heat of reaction at constant volume is measured using bomb calorimeter.

$q_V = \Delta U =$ Internal energy change

Heat of reaction at constant pressure is measured using simple or water calorimeter.

$q_p = \Delta H$

$q_p = q_V + P\Delta V$

$\Delta H = \Delta U + \Delta nRT$

The heat capacity of a bomb calorimeter is $500 JK^{-1}$. When $0.1 g$ of methane was burnt in this calorimeter, the temperature rose by $2^{\circ}C$. The value of ΔU per mole will be

A. 3

B. 2

C. 1

D. 4

Answer: C

Watch Video Solution

10. The fundamental frequencies of a closed pipe and an open pipe of different lengths are 300 Hz and 400 Hz respectively. If they are joined to form a longer pipe, the fundamental frequency of the long pipe so formed is

A. 350 Hz

B. 50 Hz

C. 120 Hz

D. 100 Hz

Answer: C

Watch Video Solution

11. A glass tube of $1.0m$ length is filled with water . The water can be drained out slowly at the bottom of the tube . If a vibrating tuning fork of frequency $500c/s$ is brought at the upper end of the tube and the velocity of sound is $330 m/s$, then the total number of resonances obtained will be

A. 4

B. 3

C. 2

D. 1

Answer: B

Watch Video Solution

12. The frequency of a stetched unifrom wire under tension is in resonance with the fundamental frequency of closed tube. If the tension in the wire is increased by 8 N, it is in resonance with the first overtone of the closed tube. The initial tension in the wire is

A. 1N

B. 4N

C. 8N

D. 16N

Answer: A

Watch Video Solution

13. 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

14. The string of a sonometer is divided into two parts with the help of a wedge. The total length of the string is 1 m and the two parts differ by 2mm. When sounded together they produced two beats per second. The frequencies of the notes emitted by the two parts are

A. 499 & 497 Hz

B. 501 & 499 Hz

C. 501 & 503 Hz

D. none

Answer: B

Watch Video Solution

15. Two uniform wire are vibrating simultaneously in their fundamental modes. The tensions, lengths, diameters, and the densities of the two wires are in the ratios, $8:1, 36:35, 4:1, 1:2$ respectively. If the note of higher pitch has a frequency of 360Hz the number of beats produced per second is

A. 5

B. 10

C. 15

D. 20

Answer: B

Watch Video Solution

PRACTICE SET (EXERCISE-V (LEVEL-II(ADVANCED) STRAIGHT OBJECTIVE TYPE QUESTIONS))

1. In a closed end pipe of length $105cm$, standing waves are set up corresponding to the third overtone . What distance from the closed end, amongst the following is a pressure node?

A. 20cm

B. 60cm

C. 85cm

D. 45cm

Answer: D

Watch Video Solution

2. 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

3. A long tube open at the top is fixed verticallly and water level inside the tube can be moved up or down . A vibrating tuning fork is held above the open end and the water level is pushed down gradually so as to get first and second resonance at $24.1cm$ and $74.1cm$, respectively below the open end . The diameter of the tube is

A. 2cm

B. 3cm

C. 4cm

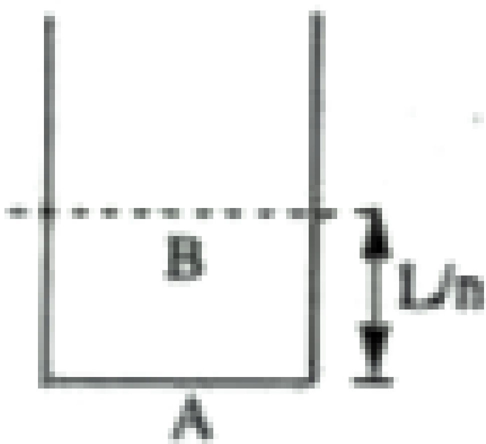
D. 5cm

Answer: B

Watch Video Solution

4. A closed organ pipe is vibrating in fundamental frequency. There are two points A and B in the organ pipe as shown, at a distance AB = L/n. Ratio of maximum pressure variation at point A to point B is

$2/\sqrt{3}$ find value of n



A. 3

B. 6

C. $\sqrt{3}$

D. 2

Answer: A

Watch Video Solution

5. A closed organ pipe of radius r_1 and an open organ pipe of radius r_2 both having same length 'L' resonate when excited with a given tunning fork. Closed organ pipe resonates in its fundamental mode where as open organ pipe resonates in its overtone , then

A. $r_2 - r_1 = L$

B. $r_2 - r_1 = L/2$

C. $r_2 = 2r_1 = 2.5L$

D. $2r_2 - r_1 = 2.5L$

Answer: C

Watch Video Solution

6. 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. $2(l_1 - l_1)$

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

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

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

Answer: C

Watch Video Solution

7. The first overtone of an open organ pipe beats with the first overtone of a closed organ pipe with a beat frequency $2.2Hz$. The fundamental frequency of the closed organ pipe is $110Hz$, find the lengths of the pipes . Take velocity of sound $= 330m/s$.

A. $l_0 = 3.8937m$

B. $l_0 = 1.9937m$

C. $l_0 = 0.9937m$

D. $l_0 = 2.8937m$

Answer: C

Watch Video Solution

8. A string under a tension of 129.6N produces 10beats/sec when it is vibrated along with a tuning fork. When the tension in the string is increased to 160N, it sounds in unision with the same fork. Calculate the fundamental frequency of the tuning fork.

A. 100Hz

B. 200Hz

C. 300Hz

D. 400Hz

Answer: A

Watch Video Solution

9. A string $25cm$ long and having a mass of $2.5g$ is under tension. A pipe closed at one end is $40cm$ long . When the string is set vibrating in its first overtone and the air in the pipe in its fundamental frequency, 8 beats per second are heard . It is observed that decreasing the tencion in the string decrease the beat frequency. If the speed of sound in air is $320m/s$, find the tension in the string.

A. 25.03 N

B. 27.04 N

C. 37.01 N

D. 20.02 N

Answer: B

Watch Video Solution

10. Find the temperature at which the fundamental frequency of an organ pipe is independent of small variation in temperature in terms of the coefficient of linear expansion (α) of the material of the tube.

A. $T_0 = \frac{5}{2\alpha}$

B. $T_0 = \frac{2}{1\alpha}$

C. $T_0 = \frac{3}{2\alpha}$

D. $T_0 = \frac{1}{2\alpha}$

Answer: D

Watch Video Solution

11. Two identical sonometer wires have a fundamental frequency of 400 vibrations per second when kept under the same tension. What fractional increase in the tension of one wire would cause an occurance of 8 beats per second when both wires vibrate together

A. 0.01

B. 0.02

C. 0.03

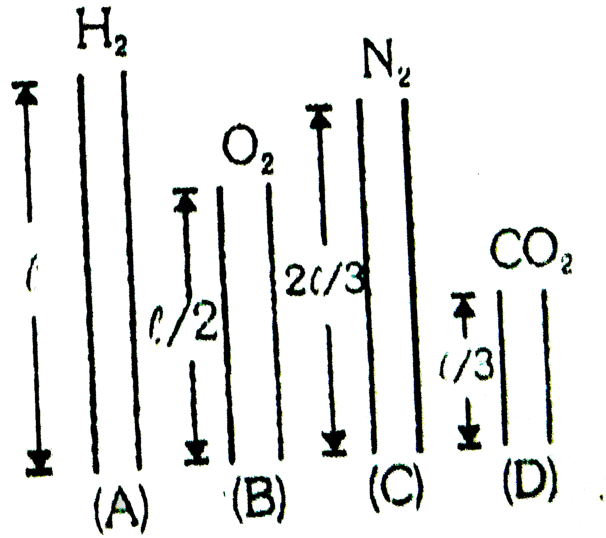
D. 0.04

Answer: B

Watch Video Solution

PRACTICE SET (EXERCISE-V (LEVEL-II(ADVANCED) MORE THAN ONE CORRECT ANSWER TYPE QUESTIONS))

1. Four open organ popes of different length and different gases at same temperature as shown in figure. Let f_A, f_B, f_C and f_D be their fundamental frequencies then : [Take $\gamma_{CO_2} = \frac{4}{3}$]



A. $f_A/f_B = 2$

B. $f_B/f_C = \sqrt{72/28}$

C. $f_C/f_D = \sqrt{11/28}$

D. $f_D/f_A = \sqrt{76/11}$

Answer: A::C::D

Watch Video Solution

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

A. 0.8 m from the open end

B. 0.4 m from the open end

C. at the closed end

D. 1.0 m from the open end

Answer: B::C

Watch Video Solution

PRACTICE SET (EXERCISE-V (LEVEL-II(ADVANCED) LINKED COMPREHENSION TYPE QUESTIONS))

1. The air column in a pipe closed at one end is made to vibrate in its third over tone by tuning fork of frequency 220Hz. The speed of sound in air is 330m/sec. End correction may be neglected. Let P_0 denote the mean pressure at any point in the pipe and ΔP_0 the maximum amplitude of pressure vibration

Find the length of the air column

A. 3.2 m

B. 2.625m

C. 4.23m

D. 1.16 m

Answer: A::B

Watch Video Solution

2. The air column in a pipe closed at one end is made to vibrate in its third over tone by tuning fork of frequency 220Hz. The speed of sound in air is 330m/sec. End correction may be neglected. Let P_0 denote the mean pressure at any point in the pipe and ΔP_0 the maximum amplitude of pressure vibration

Find the length of the air column

A. $\frac{\Delta P_0}{\sqrt{2}}$

B. $\frac{\sqrt{3}\Delta P_0}{2}$

C. ΔP_0

D. $\frac{\Delta P_0}{2}$

Answer: A

Watch Video Solution

3. The air column in a pipe closed at one end is made to vibrate in its third over tone by tuning fork of frequency 220Hz. The speed of sound in air is 330m/sec. End correction may be neglected. Let P_0 denote the mean pressure at any point in the pipe and ΔP_0 the maximum amplitude of pressure vibration

Find the length of the air column

A. P_0

B. $P_0 + \Delta P_0$

C. $P_0 + \frac{P_0}{2}$

D. none of these

Answer: A

Watch Video Solution

PRACTICE SET (EXERCISE-V (LEVEL-II(ADVANCED) MATRIX MATCHING TYPE QUESTIONS))

1. In closed organ pipe at one end-

	Column -I		Column -II
(A)	Third overtone frequency is x times fundamental frequency then x is	(P)	3
(B)	Number of nodes in second overtone	(Q)	4
(C)	Number of antinodes in second overtone	(R)	5
(D)	n^{th} harmonic does not exists, where n is	(S)	7
		(T)	6

Watch Video Solution

PRACTICE SET (EXERCISE-V (LEVEL-II(ADVANCED) INTEGER TYPE QUESTIONS))

1. Two identical flutes produce fundamental notes of frequency 300 Hz at $27^{\circ}C$. If the temperature of the air in one of the flutes is increased to $31^{\circ}C$, the number of beats heard per second will be

Watch Video Solution

2. In a standing wave pattern obtained in an open tube filled with Iodine, due to vibrations of frequency 800 cycle/sec the dist between first node, eleventh node is found to be 1 m when the temperature of iodine vapour is $352^\circ C$. If the temperature is $127^\circ C$, the distance between consecutive nodes is (in centimeters) (approximately).

Watch Video Solution

3. Two sound waves of frequencies $100 Hz$ and $102 Hz$ and having same amplitude $'A'$ are interfering. At a stationary detector, which can detect resultant amplitude greater than or equal to A. So, in a given time interval of 12 seconds, finds the total duration in which detector is active.

Watch Video Solution

PRACTICE SET (EXERCISE-VI (LEVEL-I(MAIN) STRAIGHT OBJECTIVE TYPE QUESTIONS))

1. To an observer, the pitch of a stationary source of sound appears to be reduced by 20%. If the speed of sound is 340m/s then speed and direction of the observer is

A. 86 m/s towards the source

B. 68 m/s towards the source

C. 86 m/s away from the source

D. 68 m/s away from the source

Answer: D

Watch Video Solution

2. A Car is travelling at $\frac{v}{10}ms^{-1}$ and sounds horn of frequency 990 Hz. The apparent frequency heard by a police chasing the car at $\frac{v}{9}ms^{-1}$, where V is velocity of sound

A. 990 Hz

B. 900 Hz

C. 1000 Hz

D. 0

Answer: C

Watch Video Solution

3. The wave length of the sound produced by a source is 0.8m. If the source moves towards the stationary listener at $32ms^{-1}$ what is the apparent wave length of sound if the velocity of sound is $320ms^{-1}$

A. 0.32m

B. 0.4m

C. 0.72m

D. 0.80m

Answer: C

Watch Video Solution

4. A motor cycle starts from rest and accelerates along a straight path at $2m/s^2$. At the straight point of the motor cycle there is a stationary electric siren. How far has the motor cycle gone when the driver hears the frequency of the siren at 94% of its value when the motor cycle was al rest? (Speed of sound = $330ms^{-1}$)

A. 98m

B. 147m

C. 196m

D. 49m

Answer: A

Watch Video Solution

5. The wavelength of H_α line in hydrogen spectrum was found 6563Å in the laboratory. If the wavelength of same line in the spectrum of a milky way is observed to be 6586Å, then the recessional velocity of the milky way will be

A. $0.105 \times 10^6 ms^{-1}$

B. $1.05 \times 10^6 ms^{-1}$

C. $10.5 ms^{-1}$

D. none of these

Answer: B

Watch Video Solution

6. A vehicle sounding a whistle of frequency 256Hz is moving on a straight road,towards a hill with velocity of $10ms^{-1}$. The number of beats per second observed by a person travelling in the vehicle is (velocity of sound = $300ms^{-1}$

A. 0

B. 10

C. 14

D. 16

Answer: D

Watch Video Solution

7. A source of sound and an observer are approaching each other with the same speed, which is equal to $\left(\frac{1}{10}\right)$ times the speed of sound. The apparent relative change in frequency of source is

A. 22.2% increases

B. 22.2% decreases

C. 18.2% decreases

D. 18.2% increases

Answer: A

Watch Video Solution

8. A police car moving at $22ms^{-1}$ chases a motor cyclist. The police man sounds horn at 176 Hz. While both of them move towards a stationary siren of frequency 165 Hz. If the number of beats heard by the motor cyclist per second is zero, then the speed of motorcycle is (Speed of sound in air $= 330 ms^{-1}$)

A. 33 m/s

B. 22 m/s

C. 0

D. 11m/s

Answer: B

Watch Video Solution

9. Earth is moving towards a stationary star with a velocity $100 kms^{-1}$. If the wavelength of light emitted by the star is 5000Å, then the apparent change in wavelength observed by the observer on earth will be

A. 0.67Å

B. 1.67Å

C. 16.7Å

D. 167Å

Answer: B

Watch Video Solution

10. A radar sends a radio signal of frequency $9 \times 10^3 Hz$ towards an aircraft approaching the radar. If the reflected wave shows a frequency shift of $3 \times 10^3 Hz$ the speed with which the aircraft is approaching the radar in ms-1 (velocity of the rador signal is $3 \times 10^8 ms^{-1}$)

A. 150

B. 100

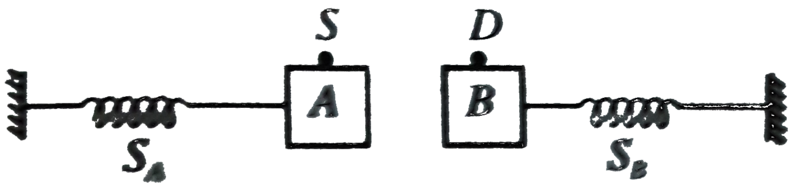
C. 50

D. 25

Answer: C

Watch Video Solution

PRACTICE SET (EXERCISE-VI (LEVEL-II(ADVANCED) STRAIGHT OBJECTIVE TYPE QUESTIONS))



1.

A source S emitting sound of 300 Hz is fixed of block A which is attached to free end of a spring S_A as shown in the figure. The detector D fixed on block B attached to the free end of spring S_B detects this sound.

The blocks A and B are simultaneously displaced towards each other through of 1.0 m and then left to vibrate. Find the maximum and minimum frequencies of sound detected by D if the vibrational frequency of each block is 2 Hz (velocity of sound is 340 m/s).

A. 323 Hz, 278.6 Hz

B. 276.8 Hz, 330 Hz

C. 260 Hz , 241 Hz

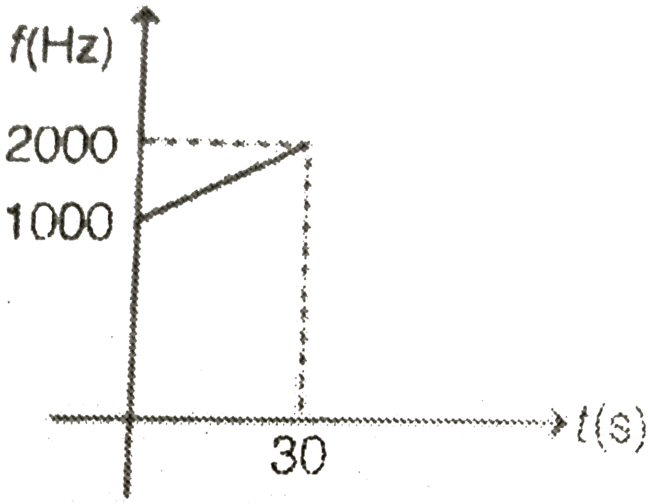
D. 340 Hz , 260 Hz

Answer: A

Watch Video Solution

2. 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

$\left(g = 10m/s^2\right)$



A. 330 m/s

B. 350 m/s

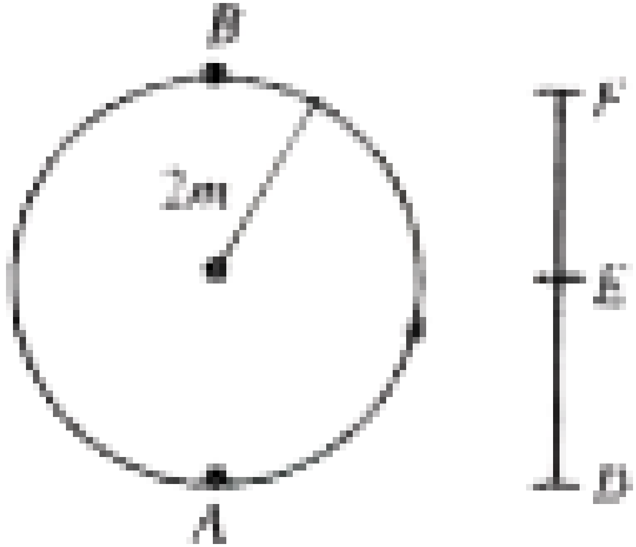
C. 300 m/s

D. 310 m/s

Answer: C

Watch Video Solution

3. A source of sound emitting a frequency 660 Hz is moving counter-clockwise in a circular path of radius 2 metres with an angular velocity 15 rad/s. A recorder at a distance from the source is moving simple harmonically along a straight line with an amplitude 2 metres. The frequency of SHM is $\frac{15}{2\pi}$ per second. The arrangement is shown in figure. When the source is at point A the detector is at D. Find the maximum and minimum frequencies recorded. Velocity of sound in air at this temperature can be taken as 300 m/s



A. 806 Hz, 540 Hz

B. 733.4 Hz, 600 Hz

C. 680 Hz, 380 Hz

D. 580 Hz, 280 Hz

Answer: B

Watch Video Solution

4. When source and detector are stationary but the wind is blowing at speed v_W, the apparent wavelength λ' on the wind side is related to actual wavelength λ by [take speed of sound is air as v]

A. $\lambda^1 = \lambda$

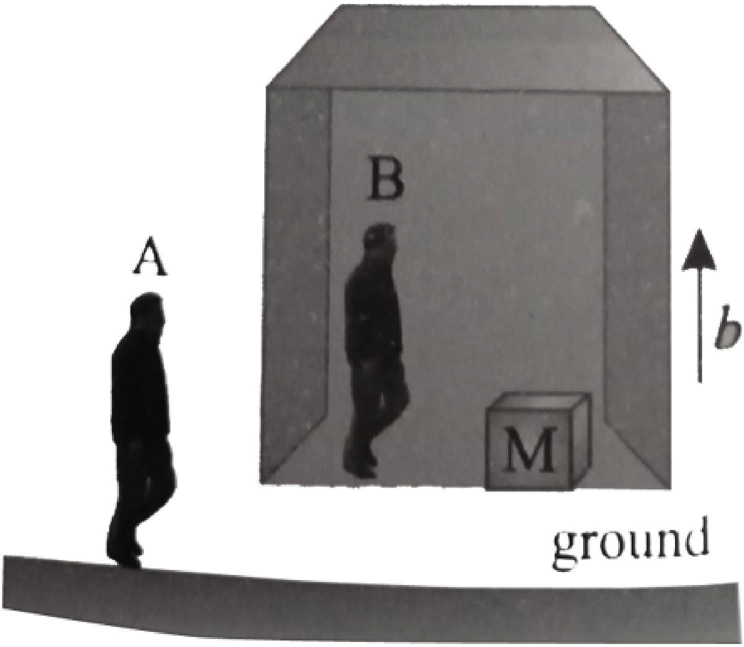
B. $\lambda^1 = \frac{V_w}{V}\lambda$

C. $\lambda^1 = \left(V_w + V\right)\frac{\lambda}{V}$

D. $\lambda^1 = \left(\frac{V}{V - V_w}\right)\lambda$

Answer: C

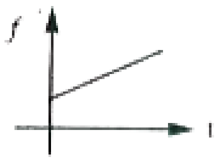
Watch Video Solution



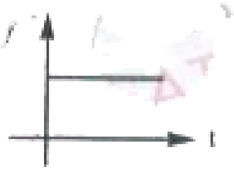
5.

A block of mass M is kept in elevator (lift) which starts moving upward with constant acceleration b as shown in figure. Initially elevator at rest. The block is observed by two observers A and B for a time interval $t = 0$ to $t = T$. Observer B is at rest with respect to elevator and observer A is standing on the ground.

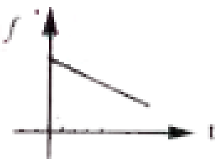
Q. The observer A finds that the work done by gravity on the block is



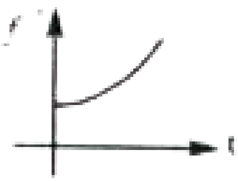
A.



B.



C.



D.

Answer: A

Watch Video Solution

6. A sounding body of negligible dimension emiting a frequency of 150 Hz is dropped from a height. During its fall under gravity it passes near a ballon moving up with a constant velocity of 2 m/s . One second after is started to fall , the difference in the frequency observed by the man in ballon just before and just after crossing the body will be (given that velocity of sound = 300 m/s , g = $10m/s^2$)

A. 12

B. 6

C. 8

D. 4

Answer: A

Watch Video Solution

7. When the medium moves and the source and observer are stationary:

A. λ changes

B. λ remains constant

C. frequency changes

D. none of these

Answer: A

Watch Video Solution

8. A source of sound attached to the bob of a simple pendulum execute SHM. The difference between the apparent frequency of sound as received by an observer during its approach and recession at the mean position of the SHM motion is 2% of the natural frequency of the source. The velocity of the source at the mean position is (velocity of sound in the air is 340 m/s) [Assume velocity of sound source << velocity of sound in air] :

A. 1.4 m/s

B. 3.4 m/s

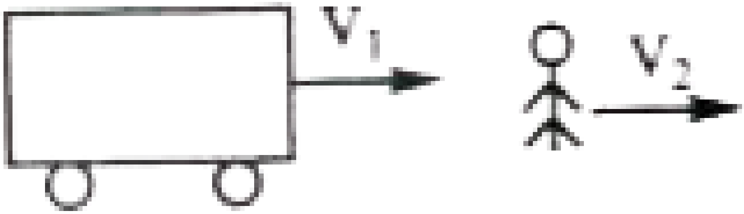
C. 1.7m/s

D. 2.1 m/s

Answer: B

Watch Video Solution

9. A car moving with a velocity v_1 overtakes a person moving with a velocity v_2 . The ratio of frequencies of sound Just before and after overtaking, is:



A. $\frac{(c - v_1)(c - v_2)}{(c + v_1)(c + v_2)}$

B. $\frac{(c + v_2)(c - v_2)}{(c - v_1)(c + v_1)}$

C. $\frac{(c + v_1)(c + v_2)}{(c - v_1)(c - v_1)}$

D. $\frac{(c - v_1)(c + v_2)}{(c + v_1)(c - v_2)}$

Answer: B

Watch Video Solution

PRACTICE SET (EXERCISE-VI (LEVEL-II(ADVANCED) MORE THAN ONE CORRECT ANSWERT TYPE QUESTIONS))

1. Consider a source of sound S, and an observer P. The source emits sound of frequency N_0. The frequency observed by P is found to be N_1 if P approaches S at a speed v and S is stationary; N_2 if S approaches P at a speed v and P is stationary and N_3 if each of P and S has speed v/2 towards one another

A. $n_1 = n_2 = n_3$

B. $n_1 < n_2$

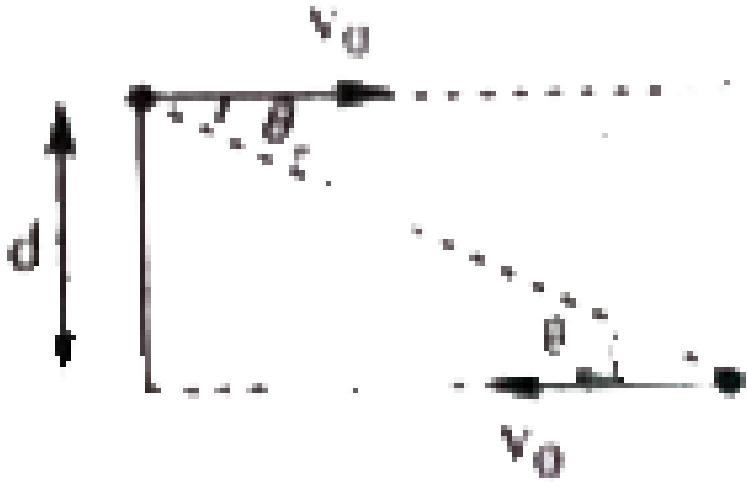
C. $n_3 > n_0$

D. n_3 lies between n_1 and n_2

Answer: B::C::D

Watch Video Solution

2. A source of sound emitting a sound of frequency f_0 and detector are moving with same speed v_0 as shown in the figure at t = 0. Take velocity of sound wave to be v (>> v_0).



For this situation mark out the correct statement(s)

A. The frequency received by the detector is always greater than f_0

B. Initially, frequency received by the detector is greater than f_0, becomes equal to f_0, and then decreases with the time.

C. Frequency received by the detector is equal to f_0 at $t = d\cot\theta_0 / (2v_0)$

D. Frequency received by the detector can never be equal to f_0

Answer: B::C

Watch Video Solution

3. Choose the correct option (S)?

A. When a source of sound move towards a stationary observer the wavelength of the sound as heard by the observer is less than the original wavelength of the source.

B. When both observer and the source of sound moves towards each other, the wave length of the sound as heard by the observer is less than the wavelength of the original sound.

C. When both observer and the source of sound moves away from each other, the wavelength of the sound as heard by the observer is less than the wavelength of the original sound.

D. When an observer moves away from a stationary source, the wavelength of the sound heard by the observer is less than the wavelength of the original sound.

Answer: A::B::C

Watch Video Solution

4. An astronaut on the Moon simultaneously drops a feather and a hammer. The fact that they land together shows that:

A. Maximum velocity of detector is $4\pi ms^{-1}$

B. Maximum frequency detected by detector is 323 Hz (approximately)

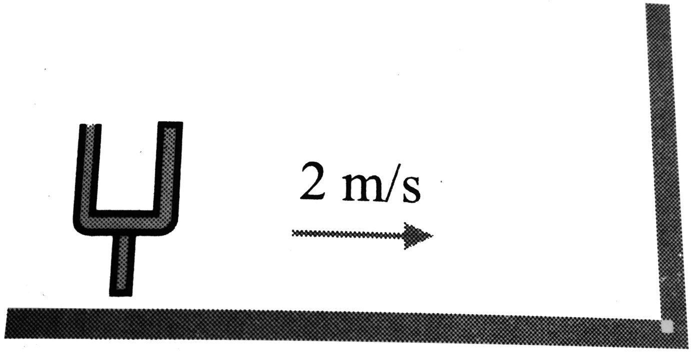
C. Minimum frequency detected by detector is 278 Hz (approximately)

D. The phase difference between S and D is $\frac{\pi}{4}$

Answer: A::B::C

Watch Video Solution

PRACTICE SET (EXERCISE-VI (LEVEL-II(ADVANCED) LINKED COMPREHENSION TYPE QUESTIONS))



1.

As shown if Fig. a vibrating tuning fork of frequency 512 Hz is moving towards the wall with a speed $2\frac{m}{s}$. Take speed of sound as $v = 340\frac{m}{s}$ and answer the following questions.

Q. Suppose that a listener is located at rest between the tuning fork and the wall. Number of beats heard by the listener per second will be

A. 4

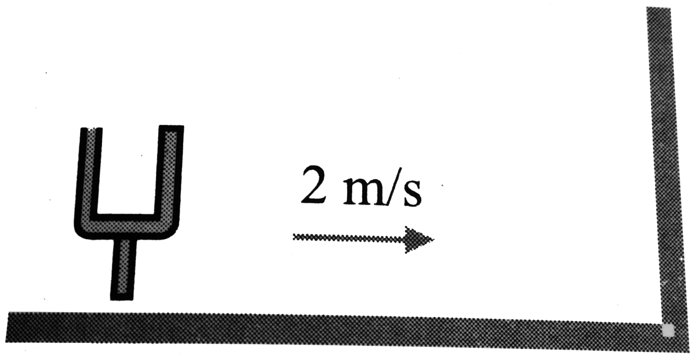
B. 3

C. 0

D. 1

Answer: C

Watch Video Solution



2.

As shown if Fig. a vibrating tuning fork of frequency 512 Hz is moving towards the wall with a speed $2\frac{m}{s}$. Take speed of sound as $v = 340\frac{m}{s}$ and answer the following questions.

Q. If the listener, along with the source, is moving towards the wall with the same speed i.e., $2\frac{m}{s}$, such that the source remains between the listerner and the wall, number of beats heard by the listener per second will be

A. 3

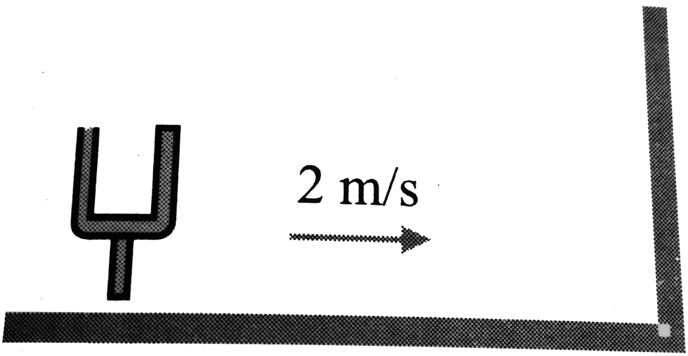
B. 8

C. 0

D. 6

Answer: D

Watch Video Solution



3.

As shown if Fig. a vibrating tuning fork of frequency 512 Hz is moving towards the wall with a speed $2\frac{m}{s}$. Take speed of sound as $v = 340\frac{m}{s}$

and answer the following questions.

Q. If the listerner along with the source is moving towards the wall with the same speed i.e., $2\frac{m}{s}$, such that he (listener) remains between the source and the wall, number of beats heard by him will be

A. 2

B. 6

C. 8

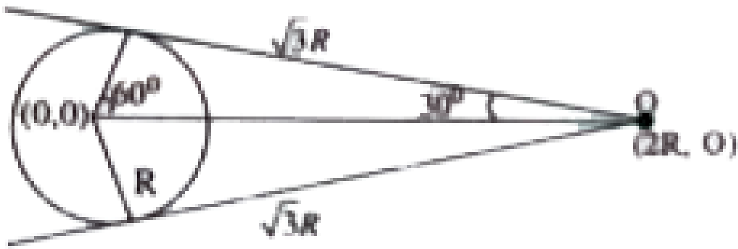
D. 4

Answer: B

Watch Video Solution

4. A source is moving along a circle $X^2 + Y^2 = R^2$ with constant speed $V_s = \frac{330\pi}{6\sqrt{3}}$ m/s in clockwise direction while on observer is stationary at point (2R,0) with respect to the centre of circle

frequency emitted by the source is f [velocity of sound V= 330 m/s]



Maximum wave length received observer

A. $\left(\frac{R}{2}, \frac{R}{2}\right)\left(\frac{R}{2}, -\frac{R}{2}\right)$

B. $\left(\frac{R}{2}, \frac{\sqrt{3}R}{2}\right)\left(\frac{R}{2}, \frac{-\sqrt{3}R}{2}\right)$

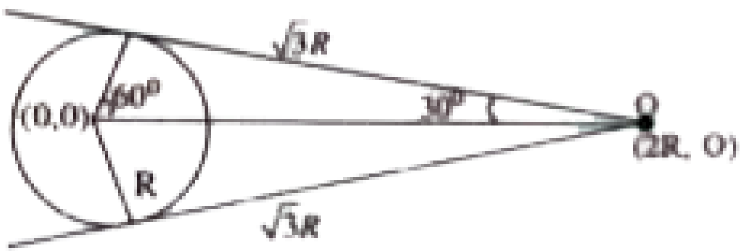
C. $\left(\frac{\sqrt{3}R}{2}, \frac{\sqrt{3}R}{2}\right)\left(\frac{\sqrt{3}R}{2}, \frac{\sqrt{3}}{2}R\right)$

D. $\left(\frac{\sqrt{3}R}{2}, \frac{R}{2}\right)(0, -R)$

Answer: D

Watch Video Solution

5. A source is moving along a circle $X^2 + Y^2 = R^2$ with constant speed $V_s = \frac{330\pi}{6\sqrt{3}}$ m/s in clockwise direction while on observer is stationary at point (2R,0) with respect to the centre of circle frequency emitted by the source is f [velocity of sound V= 330 m/s]



Maximum frequency heard by observer

A. $\left[\frac{\sqrt{3}}{\sqrt{3} - \pi}\right]f$

B. $\left[\frac{6\sqrt{3}}{6\sqrt{3} - \pi}\right]f$

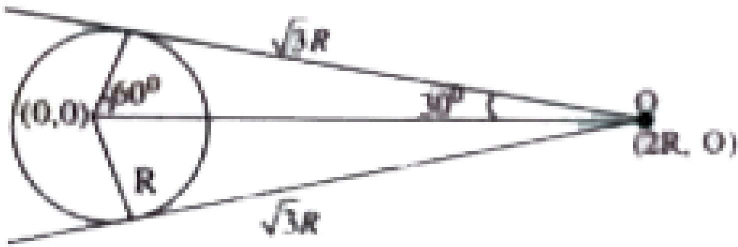
C. $\left[\frac{6}{6 - \pi}\right]f$

D. $\left[\frac{6\sqrt{3}}{6 - \pi}\right]f$

Answer: B

Watch Video Solution

6. A source is moving along a circle $X^2 + Y^2 = R^2$ with constant speed $V_s = \frac{330\pi}{6\sqrt{3}}$ m/s in clockwise direction while on observer is stationary at point (2R,0) with respect to the centre of circle frequency emitted by the source is f [velocity of sound V= 330 m/s]



Maximum wave length received observer

A. $\left(\sqrt{3} + n\pi\right)\frac{V}{f}$

B. $\left(\frac{6+\pi}{6}\right)\frac{V}{f}$

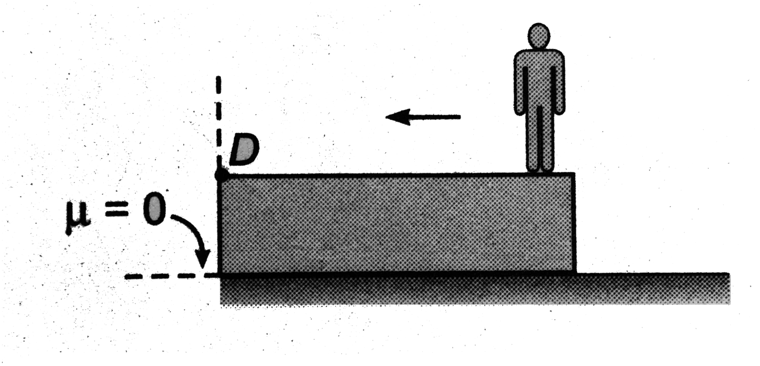
C. $\left(\frac{6\sqrt{3}-\pi}{6\sqrt{3}}\right)\frac{V}{f}$

D. $\left(\frac{6\sqrt{3}+\pi}{6\sqrt{3}}\right)\frac{V}{f}$

Answer: D

Watch Video Solution

7. A man of mass $50kg$ is runing on a plank of mass $150kg$ with speed of $8m/s$ relative to plank as shows in the figure (both were initially at rest and velocity of man with respect to ground any how remains constant). Plank is placed on smooth horizontal surface. The man, while running, whistle with frequency f_o. A detected (D) placed on plank detects frequency. The man jumps off with same velocity (w.r.t. to ground) from point D and slides on the smooth horizontal surface [Assume coefficient of friction between man and horizontal is zero]. The speed of sound in still medium is $330m/s$. Answer the following questions on the basis of above situations.



The frequency of sound detected by detector D, before man jumps of the plank is

A. $\frac{332}{324} f_0$

B. $\frac{330}{322} f_0$

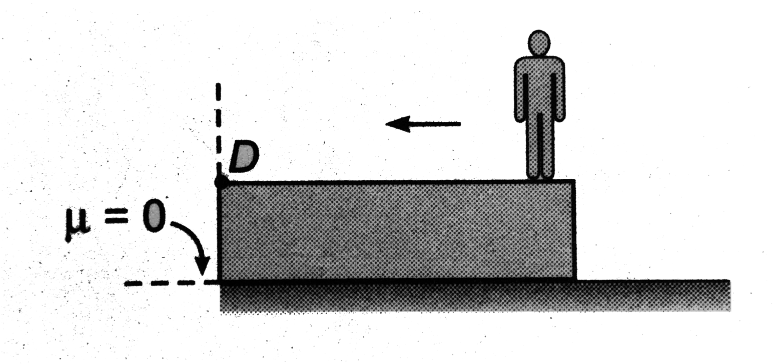
C. $\frac{328}{336} f_0$

D. $\frac{328}{338} f_0$

Answer: A

Watch Video Solution

8. A man of mass $50kg$ is runing on a plank of mass $150kg$ with speed of $8m/s$ relative to plank as shows in the figure (both were initially at rest and velocity of man with respect to ground any how remains constant). Plank is placed on smooth horizontal surface. The man, while runing, whistle with frequency f_o. A detected (D) placed on plank detects frequency. The man jumps off with same velocity (w.r.t. to groung) from point D and slides on the smooth horizontal surface [Assume coefficient of friction between man and horizontal is zero]. The speed of sound in still medium is $330m/s$. Answer the following questions on the basis of above situations.



A. $\frac{332}{324}f_0$

B. $\frac{330}{322}f_0$

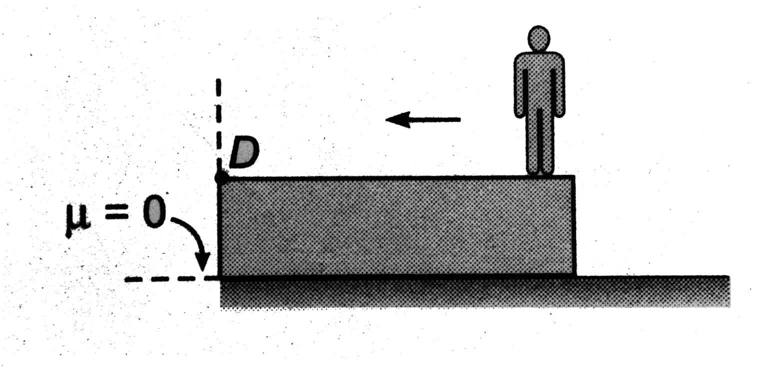
C. $\frac{328}{336}f_0$

D. $\frac{328}{338}f_0$

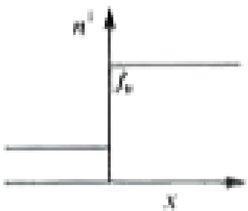
Answer: C

Watch Video Solution

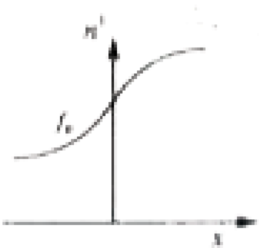
9. A man of mass $50kg$ is runing on a plank of mass $150kg$ with speed of $8m/s$ relative to plank as shows in the figure (both were initially at rest and velocity of man with respect to ground any how remains constant). Plank is placed on smooth horizontal surface. The man, while runing, whistle with frequency f_o. A detected (D) placed on plank detects frequency. The man jumps off with same velocity (w.r.t. to groung) from point D and slides on the smooth horizontal surface [Assume coefficient of friction between man and horizontal is zero]. The speed of sound in still medium is $330m/s$. Answer the following questions on the basis of above situations.



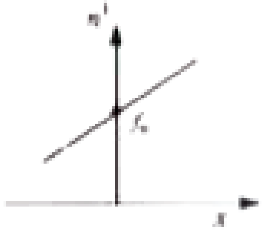
A.



B.



C.



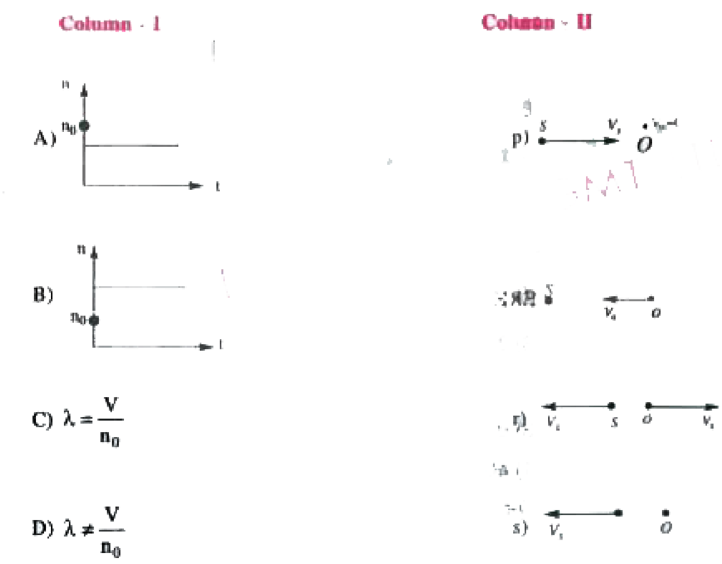
D.

Answer: A

Watch Video Solution

PRACTICE SET (EXERCISE-VI (LEVEL-II(ADVANCED) MATRIX MATCHING TYPE QUESTIONS))

1. The following figures in the Column-II indicate the direction of motion of source and the observer match the corresponding graph in Column-I drawn between the apparent frequency. and time V_0 is the velocity of observer V_s the velocity of source, and n_0 the frequency of the source



Watch Video Solution

PRACTICE SET (EXERCISE-VI (LEVEL-II(ADVANCED) INTEGER TYPE QUESTIONS))

1. Two trains are moving towards each other at speed of 144 km/hr and 54 km/hr relative to the ground. The second sounds a whistle of frequency 710 Hz, the frequency of this whistle as heard by a passenger in the first train after the trains have crossed each other is $x \times 10^2 Hz$, what is value of x. (v = 340 m/s)

Watch Video Solution

2. A car with a horn of frequency 620 Hz travels towards a large wall at a speed of $20ms^{-1}$ the frequency of echo of sound as heard by the driver is $x \times 10^2 Hz$, what is the value of x (velocity of sound -330m/s

Watch Video Solution

3. One train is approaching an observer at rest and another train is receding him with same velocity $4ms^{-1}$. Both the trains blow whistles of same frequency of 243 Hz. The beat frequency in Hz as heard by the observer is (speed of sound in air=$320ms^{-1}$)

Watch Video Solution

4. The frequency of a source of sound as measured by an observer when the source is moving towards him with a speed of 30 m/s is 720 Hz. The apparent frequency when the source is moving away after crossing the observer is $x \times 10^2 Hz$ what is the value of x. ....

(velocity of sound is 330 m/s)

Watch Video Solution

ADDITIONAL PRACTICE EXERCISE (LEVEL-I(MAIN) STRAIGHT OBJECTIVE TYPE QUESTIONS))

1. The intensity of a sound wave gets reduced by 20% on passing through a slab. The reduction intensity on passage through two such consecutive slabs

A. 0.4

B. 0.36

C. 0.3

D. 0.5

Answer: B

Watch Video Solution

2. A string of length l is stretched by 1/30 and transverse waves in the string are found to travel at a speed v_0. Speed of transverse waves when the string is stretched by 1/15 will be :

A. $\frac{v_0}{2}$

B. $2v_0$

C. $2\sqrt{2}v_0$

D. $\sqrt{2}v_0$

Answer: D

Watch Video Solution

3. The speed of a wave on a string is 150 m/s when the tension is 120 N . The percentage increase in the tension in order to raise the wave speed by 20% is

A. 0.44

B. 0.4

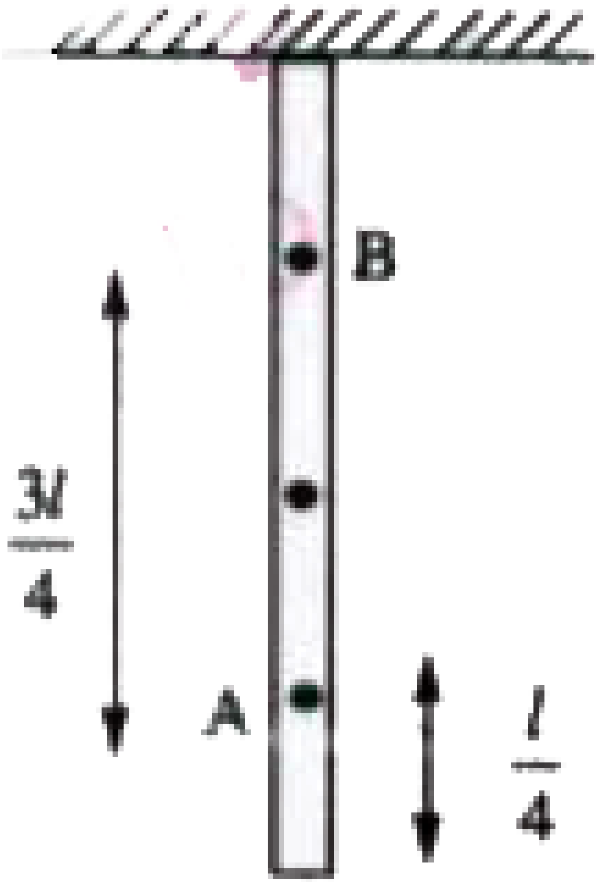
C. 0.2

D. 0.1

Answer: A

Watch Video Solution

4. A string of mass m and length l is hanging from ceiling as shown in the Fig. Wave in string move upward. $v_A$and v_B are the speed of wave at A and B respectively. Then v_B is :



A. $\sqrt{3}v_A$

B. v_A

C. $< v_A$

D. $\sqrt{2}v_A$

Answer: A

Watch Video Solution

5. Two vibrating tunign forks produce progessive waves given by

$y_1 = 4\sin 500\pi t$ and $y_2 2\sin 506\pi t$.

Number of beat produced pre minture is .

A. 3 beats/s with intensity ratio between maxima and minima equal to 2

B. 3 beats/s with intensity ratio between maxima and minima equal to 9

C. 6 beats/s with intensity ratio between maxima and minima equal to 2

D. 6 beats/s with intensity ratio between maxima and minima equal to 9

Answer: A

Watch Video Solution

6. two waves of wavelengths 2 m and 2.02 m respectively, moving with the same velocity superpose to produce 2 beats per second. The velocity of the wave is

A. 400.0 m/s

B. 402.0 m/s

C. 404.0 m/s

D. 406.0 m/s

Answer: C

Watch Video Solution

7. A glass tube of $1.0m$ length is filled with water . The water can be drained out slowly at the bottom of the tube . If a vibrating tuning fork of frequency $500Hz$ is brought at the upper end of the tube and the velocity of sound is $300m/s$, then the total number of resonances obtained will be

A. 4

B. 3

C. 2

D. 1

Answer: B

Watch Video Solution

8. An object producing a pitch of 100 h=Hz approaches a stationary person in a straight line with a velocity of 200 m/s. Velocity of sound is 300 m/s. The person will note a change in frequency, as the object flies past him equal to

A. 1440 Hz

B. 240 Hz

C. 1200 Hz

D. 960 Hz

Answer: D

Watch Video Solution

9. In an experiment it was found that a sonometer in its fundamental mode of vibration and a tuning fork gave 5 beats when length of wire is 1.05 metre or 1 metre. The velocity of tranverse waves in sonometer wire when its length is 1m

A. 400 m/s

B. 210 m/s

C. 420 m/s

D. 450 m/s

Answer: C

Watch Video Solution

10. A person with vibrating tuning fork of frequency 338 Hz is moving towards a vertical wall with speed of $2ms^{-1}$ Velocity of sound in air is $340ms^{-1}$ The number of beats heard per second is

A. 2

B. 4

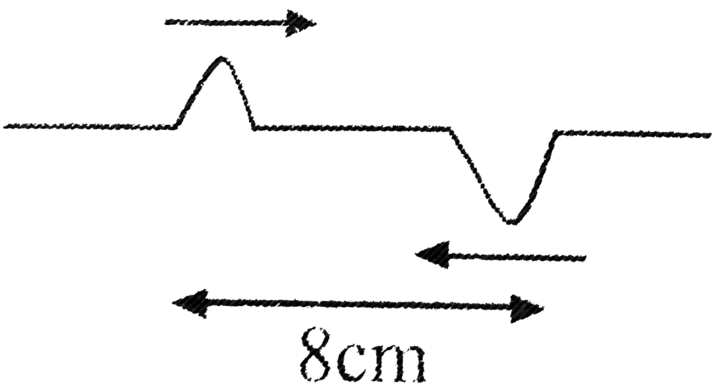
C. 6

D. 8

Answer: B

Watch Video Solution

11. Two pulses in a stretched string whose centres are initially 8 cm apart are moving towards each other as shown in the figure. The speed of each pulse is 2 cm/s. After 2 second, the total energy of the pulses will be



A. zero

B. purely kinetic

C. purely potential

D. partly kinetic and partly potential

Answer: B

Watch Video Solution

12. 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

A. 0.05s

B. 0.10s

C. 0.20s

D. 0.40s

Answer: B

Watch Video Solution

Watch Video Solution

13. The extension in a string obeying Hooke's law is x. The speed of transverse wave in the stretched string is v. If the extension in the string is increased to 1.5x, the speed of transverse wave will be

A. 1.22v

B. 0.61v

C. 1.50v

D. 0.75v

Answer: A

Watch Video Solution

14. The displacement of a particle in a periodic motion is given by $y = 4\cos^2(t/2)\sin(1000t)$. This displacement may be considered as the result superposition of n independent harmonic oscillations. Here , n is

A. two

B. three

C. four

D. five

Answer: B

Watch Video Solution

ADDITIONAL PRACTICE EXERCISE (LEVEL-II(LACTURE SHEET ADVANCED) MORE THAN ONE CORRECT ANSWER TYPE QUESTIONS))

1. $y(x, t) = 0.8/\left[(4x+5t)^2+5\right]$ represent a moving pulse, where x and y are in metres and t is in seconds, then

A. pulse is moving in +x-direction

B. in 2 seconds it will travel a distance of 2.5 m

C. its maximum displacement is 0.16 m

D. it is symmetric pulse

Answer: B::C

Watch Video Solution

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

A. electric field

B. magnetic field

C. displacement

D. pressure

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

Watch Video Solution

3. As a wave propagates

A. the wave intensity remains constant for a plane wave

B. the wave intensity decreases as the inverse of the distance from the source for a spherical wave

C. the wave intensity decreases as the inverse square of the distance from the source for a spherical wave

D. total intensity of the spherical wave over the spherical surface centred at the source remains constant at all times

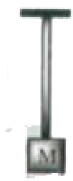
Answer: A::C::D

Watch Video Solution

ADDITIONAL PRACTICE EXERCISE (LEVEL-II(LACTURE SHEET ADVANCED) MATRIX MATCHING TYPE QUESTIONS))

1. Let is consider the following diagram in which a block of mass M is being supported by a uniform rope of mass 1 kg and length 10 metre, a pulse is created at the bottom of the rope and it reaches the top. In column I the value of M in kg is given and in column II time (in sec) after which the pulse reaches the top is given. Match them

Column - I	Column - II
A) 1	p) $2(2-\sqrt{3})$
B) 2	q) $2(\sqrt{5}-2)$
C) 3	r) $2(2+\sqrt{3})$
D) 4	s) $2(\sqrt{2}-1)$



Watch Video Solution

2. Consider a situation (i) that two sound waves, $y_1 = (0.2m)\sin 504\pi(t - x/300)$ and $y_2 = (0.6m)\sin 496\pi(t - x/300)$, are superimposed. Consider another situation (ii) that two sound waves, $y'_1 = (0.4m)\sin 504\pi(t - x/300)$ and $y'_2 = (0.4m)\sin 504\pi(t + x/300)$, are superimposed.

Match the Column-I and Column-II

Column-I	Column-II
(A) In situation (i)	(p) Stationary waves are formed
(B) In situation (ii)	(q) There will be the phenomenon of 'Beats'
(C) When two waves of same frequency and amplitude and travelling in opposite directions superimpose	(r) Amplitude of the resultant wave will vary periodically with position
(D) If the intensity of sound alternately increases and decreases periodically as a result of superposition of waves of slightly different frequency	(s) Amplitude of the resultant wave will vary periodically
	(t) Amplitude of the resultant wave is constant

Watch Video Solution

ADDITIONAL PRACTICE EXERCISE (LEVEL-II(LACTURE SHEET ADVANCED) LINKED COMPREHENSION TYPE QUESTIONS))

1. A child playing with a long rope ties one end holds the other. The rope is stretched taut along the horizontal. The child shakes the end he is holding, up and down, in a sinusoidal manner with amplitude

$10cm$ and frequency 3 Hz.

Speed of the wave is $15m/s$ and, at $t = 0$, displacement at the child's end is maximum positive. Assuming that there is no wave reflected from the fixed end, so that the waves in the rope are plane progressive waves, answer the following quetions.

(Also assume that the wave propagates along the positive x-direction.)

A wave function that describe the wave in the given sutuation is

A. y = (0.1m) cos[(2 rad / m) x - (12.5 rad / s) t]

B. y = (0.1m) cos[(1.26 rad / m) x - (18.8 rad / s) t]

C. y = (0.1m) sin[(1.5 rad 7 m) x - (10 rad / s) t]

D. y = (0.1m) sin[(2 rad 7 m) x - (4 rad / s) t]

Answer: B

Watch Video Solution

2. A child playing with a long rope ties one end holds the other. The rope is stretched taut along the horizontal. The child shakes the end he is holding, up and down, in a sinusoidal manner with amplitude $10 cm$ and frequency 3 Hz.

Speed of the wave is $15 m/s$ and, at $t = 0$, displacement at the child's end is maximum positive. Assuming that there is no wave reflected from the fixed end, so that the waves in the rope are plane progressive waves, answer the following quetions.

(Also assume that the wave propagates along the positive x-direction.)

Phase difference between the child,s end and a point $2.5 m$ from the child's end will be

A. y = -(0.1 m) cos (18.8 rad / s) t

B. y = (0.1 m) cos (12.5 rad / s) t

C. y = (0.1 m) sin (4 rad / s) t

D. y = -(0.1 m) sin (10 rad / s) t

Answer: A

Watch Video Solution

3. A child playing with a long rope ties one end holds the other. The rope is stretched taut along the horizontal. The child shakes the end he is holding, up and down, in a sinusoidal manner with amplitude $10cm$ and frequency 3 Hz.

Speed of the wave is $15m/s$ and, at $t=0$, displacement at the child's end is maximum positive. Assuming that there is no wave reflected from the fixed end, so that the waves in the rope are plane progressive waves, answer the following quetions.

(Also assume that the wave propagates along the positive x-direction.)

Phase difference between the child,s end and a point $2.5m$ from the child's end will be

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

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

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

D. π

Answer: D

Watch Video Solution

4. A child playing with a long rope ties one end holds the other. The rope is stretched taut along the horizontal. The child shakes the end he is holding, up and down, in a sinusoidal manner with amplitude $10cm$ and frequency 3 Hz.

Speed of the wave is $15m/s$ and, at $t = 0$, displacement at the child's end is maximum positive. Assuming that there is no wave reflected from the fixed end, so that the waves in the rope are plane progressive waves, answer the following quetions.

(Also assume that the wave propagates along the positive x-direction.)

Phase difference between the child,s end and a point $2.5m$ from the child's end will be

A. 3m/s

B. 4.5m/s

C. 0

D. 12.5 m/s

Answer: C

Watch Video Solution

5. One end of a long rope is tied to a fixed vertical pole. The rope is stretched horizontally with a tension 8 N. Let us consider the length of the rope to be along X-axis. A sample harmonic oscillator at x = 0 generates a transverse wave of frequency 100 Hz and amplitude 2 cm along the rope. Mass of a unit length of the rope is 20 gm/m.

Ignoring the effect of gravity, answer the following questions

Wavelength of the wave is

A. 50cm

B. 20cm

C. 8cm

D. 32cm

Answer: B

Watch Video Solution

6. The weight of an object on the surface of the Earth is 40 N. Its weight at a height equal to the radius of the Earth is

A. $y = (0.02m)\cos[8\pi(rad/m)x - 100\pi(rad/s)t]$

B. $y = (0.02m)\cos[10\pi(rad/m)x - 200\pi(rad/s)t]$

C. $y = (0.02m)\cos[10\pi(rad/m)x - 200\pi(rad/s)t - \pi]$

D. $y = -(0.02m)\sin\left[8\pi\left(ra\frac{d}{x}m\right)x - 100\pi(rad/s)t\right]$

Answer: C

Watch Video Solution

7. One end of a long rope is tied to a fixed vertical pole. The rope is stretched horizontally with a tension 8 N. Let us consider the length of the rope to be along X-axis. A sample harmonic oscillator at x = 0 generates a transverse wave of frequency 100 Hz and amplitude 2 cm along the rope. Mass of a unit length of the rope is 20 gm/m. Ignoring the effect of gravity, answer the following questions

Wavelength of the wave is

A. The wave propagates with a fixed and any particle of the medium vibrates with the same fixed speed

B. The wave propagates with a fixed speed but any particle of the medium vibrates with a variable speed

C. The wave propagates with a variable speed but any particle of the medium vibrates with some fixed speed

D. The wave propagates with a variable speed and any particle of the medium also vibrates with a variable speed

Answer: B

Watch Video Solution

8. A current I is flowing in a straight conductor of length L. The magnetic induction at a point distant $\frac{L}{4}$ from its centre will be

A. $7888 m/s^2$

B. $8244 m/s^2$

C. $9277 m/s^2$

D. $3333 m/s^2$

Answer: A

Watch Video Solution

9. A spaceship is returning to Earth with its engine turned off. Consider only the gravitational field of Earth and let M be the mass of Earth, m be the mass of the spaceship, and R be the radius of Earth. In moving from position 1 to position 2 the kinetic energy of the spaceship increases by:

A. speed of transverse waves in the rope will be doubled, wavelength will not change

B. speed of transverse waves in the rope will become half, wavelength will become one-fourth

C. speed of transverse waves in the rope will become four times, wavelength will be doubled

D. speed of transverse waves in the rope will not change, wavelength will become half

Answer: D

Watch Video Solution

ADDITIONAL PRACTICE EXERCISE (LEVEL-II(LACTURE SHEET ADVANCED) INTEGER TYPE QUESTIONS))

1. 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?

Watch Video Solution

2. In a sonometer wire, the tension is maintained by suspending a 50.7 kg mass from the free end of the wire. The suspended mass has a volume of $0.0075m^3$. The fundamental frequency of vibration of the wire is 260 Hz. If the suspended mass is completely submerged in water, the fundamental frequency will become ________ Hz.

Watch Video Solution

3. A string with tension T and mass per unit length μ is clamped down at x=0 and at x=L. at t=0, the string is at rest and displaced in the y-direction

$$y(x, 0) = 2\sin\frac{2\pi x}{L} + 2\sin\frac{\pi x}{L}$$

Q. The string is released at t=0, and it starts to oscillate. the displacement of string at time t is

Watch Video Solution

Watch Video Solution

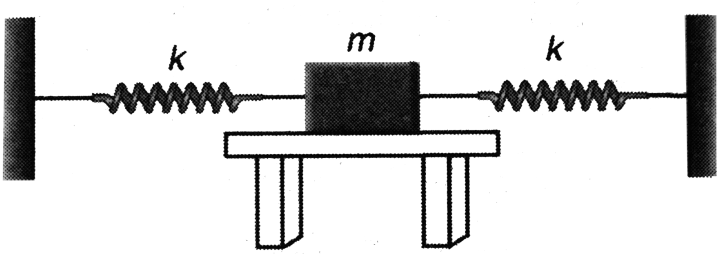
4. A gas is a mixture of two parts by volume of hyprogen and part by volume of nitrogen at STP. If the velocity of sound in hydrogen at $0\,^{\circ}C$ is $1300 m/s$. Find the velocity of sound in the gaseous mixure at $27\,^{\circ}C$.

Watch Video Solution

5. A unifrom rope of mass 0.1kg and length 2.45 m hangs from a rigid support. The time taken by the transverse wave formed in the rope to travel through the full length of the rope is (Assume g= $= 9.8 m/s^2$)

Watch Video Solution

6. 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.



Watch Video Solution

PRACTICE SHEET ADVANCED (MORE THAN ON CORRECT ANSWER TYPE QUESTIONS)

1. In case of superposition of waves (at x = 0). $y_1 = 4\sin(1026\pi t)$ and $y_2 = 2\sin(1014\pi t)$

A. the frequency of resulting wave is 510 Hz

B. the amplitude of resulting wave varies of frequency 3 Hz

C. the frequency of beats is 6 Hz

D. the ratio of maximum to minimum intensity is 9

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

Watch Video Solution

2. The vibrations of a string of length 60 cm fixed at both ends are represented by the equation $y = 4\sin\left(\frac{\pi x}{15}\right)\cos(96\pi t)$, where x and y are in cm and t in seconds.

(a)What is the maximum displacement of a point at $x = 5cm$?

(b)Where are the nodes located along the string?

(c)What is the velocity of the particle at x=7.5cm and t=0.25s?

(d)Write down the equations of the component waves whose superposition gives the above wave.

A. maximum displacement of a particle at a point at x = t cm is 4 cm

B. third node is formed at 30 cm from one end of the string

C. the velocity of a particle at x = 7.5 cm and t = 0.25 s is zero

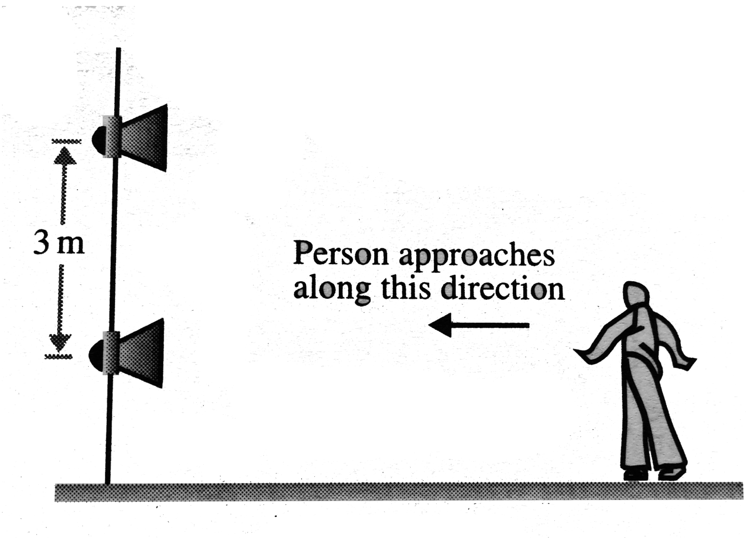
D. equations of the component waves whose superposition gives the above equation are $y_1 = -2\sin\left(\frac{\pi x}{15} - 96\pi t\right)$ and $y_2 = 2\sin\left(\frac{\pi x}{15} + 96\pi t\right)$

Answer: B::C::D

Watch Video Solution

PRACTICE SHEET ADVANCED (LINKED COMPREHENSION TYPE QUESTIONS)

1. An oscillator of frequency $680Hz$ drives two speakers . The speakers are fixed on a vertical pole at a distance $3m$ from each other as shown in Fig. 7.103. A person whose height is almost the same as that of the lower speaker walks towards the lower speaker in a direction perpendicular to the pole. Assuming that there is no reflection of sound from the ground and speed of sound is $v = 340m/s$, answer the following questions.



As the person walks towards the pole , his distance from the pole when he first hears a minimum in sound intensity is nearly

A. 14.6m

B. 17.9m

C. 10.1m

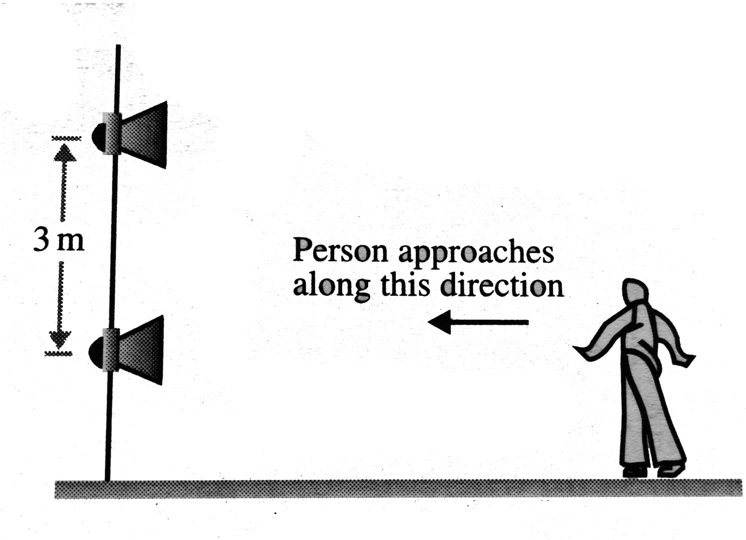
D. 22.4m

Answer: B

Watch Video Solution

2. An oscillator of frequency $680Hz$ drives two speakers . The speakers are fixed on a vertical pole at a distance $3m$ from each other as shown in Fig. 7.103. A person whose height is almost the same as that of the lower speaker walks towards the lower speaker in a direction perpendicular to the pole. Assuming that there is no reflection of sound from the ground and speed of sound is

$v = 340 m/s$, answer the following questions.



How far is the person from the pole when he hears a minimum in sound intensity a second time ?

A. 5.6m

B. 7.8m

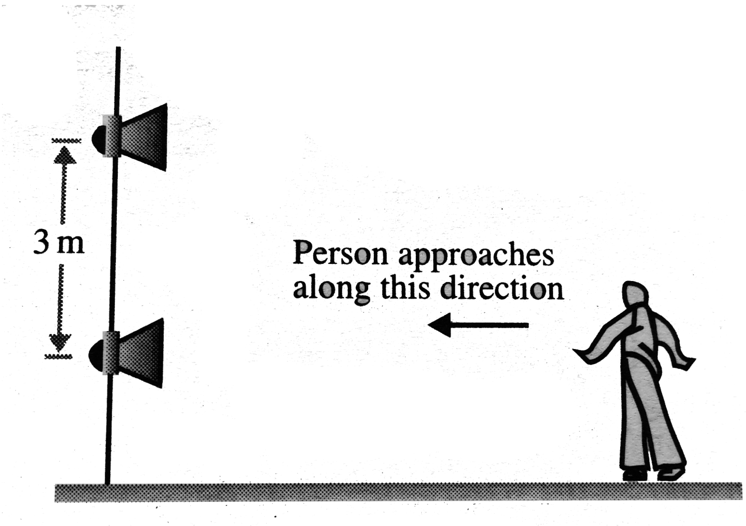
C. 12.4m

D. 17.6m

Answer: A

Watch Video Solution

3. An oscillator of frequency $680Hz$ drives two speakers . The speakers are fixed on a vertical pole at a distance $3m$ from each other as shown in Fig. 7.103. A person whose height is almost the same as that of the lower speaker walks towards the lower speaker in a direction perpendicular to the pole. Assuming that there is no reflection of sound from the ground and speed of sound is $v = 340m/s$, answer the following questions.



As the person walks toward the pole , the total number of times that the person hears a minimum in sound intensity will be

A. 2

B. 8

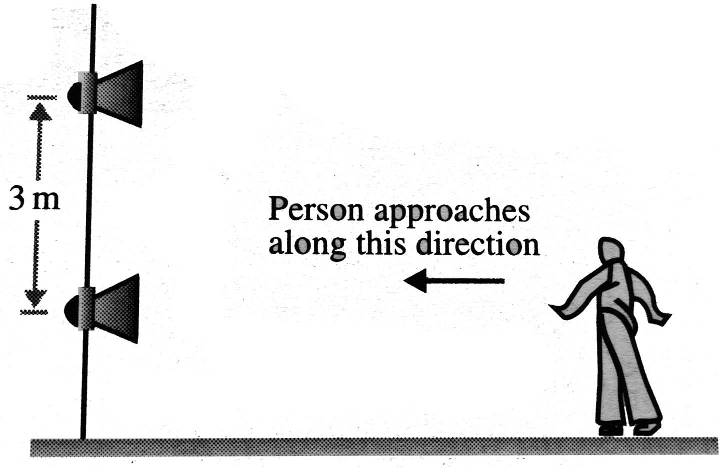
C. 4

D. 6

Answer: D

Watch Video Solution

4. An oscillator of frequency $680Hz$ drives two speakers . The speakers are fixed on a vertical pole at a distance $3m$ from each other as shown in Fig. 7.103. A person whose height is almost the same as that of the lower speaker walks towards the lower speaker in a direction perpendicular to the pole. Assuming that there is no reflection of sound from the ground and speed of sound is $v = 340m/s$, answer the following questions.



At some instant, when the person is at a distance $4m$ from the pole, the wave function (at the person's location) that describes the waves coming from the lower speaker $y = A\cos(kx - \omega t)$, where A is the amplitude, $\omega = 2\pi v$ with $v = 680Hz$ (given) and $k = 2\pi/\lambda$

Wave function (at the person's location) that describes waves coming from the upper speaker can be expressed as :

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

B. $y = A\cos(kx - \omega t + \pi/2)$

C. $y = A\cos(kx - \omega t + 2\pi)$

D. $y = A\cos\left(kx - \omega t + \frac{3\pi}{2}\right)$

Answer: C

Watch Video Solution

5. A vertical pipe open at both ends is partially submerged in water . A tuning fork is unknown frequency is placed near the top of the pipe and made to vibrate . The pipe can be moved up and down and thus length of air column the pipe can be adjusted. For definite lengths of air column in the pipe, standing waves will be set up as a result of superposition of sound waves traveling in opposite directions. Smallest value of length of air column , for which sound intensity is maximum is $10cm$ [take speed of sound , $v = 344m/s$].

Answer the following questions.

The air column here is closed at one end because the surface of water acts as a wall. Which of the following is correct ?

A. At the closed end of the air column, there is a displacement node and also a pressure node

B. At the closed end of the air column, there is a displacement node and a pressure antinode

C. At the closed end of the air column, there is a displacement antinode and a pressure node

D. At the closed end of the air column, there is a displacement antinode and also a pressure antinode

Answer: B

Watch Video Solution

6. A vertical pipe open at both ends is partially submerged in water . A tuning fork is unknown frequency is placed near the top of the pipe and made to vibrate . The pipe can be moved up and down and thus length of air column the pipe can be adjusted. For definite lengths of air column in the pipe, standing waves will be set up as a result of superposition of sound waves travelling in opposite directions. Smallest value of length of air column , for which sound intensity is maximum is $10cm$[take speed of sound , $v = 344m/s$].

Answer the following questions.

Frequency of the tuning fork is

A. 1072 Hz

B. 940 Hz

C. 860 Hz

D. 533 Hz

Answer: C

Watch Video Solution

7. A vertical pipe open at both ends is partially submerged in water . A tuning fork is unknown frequency is placed near the top of the pipe and made to vibrate . The pipe can be moved up and down and thus length of air column the pipe can be adjusted. For definite lengths of air column in the pipe, standing waves will be set up as a result of superposition of sound waves travelling in opposite directions. Smallest value of length of air column , for which sound intensity is maximum is $10cm$[take speed of sound , $v = 344m/s$]. Answer the following questions.

Length of air column for third resonance will be

A. 30cm

B. 45cm

C. 20cm

D. 50cm

Answer: A

Watch Video Solution

8. A vertical pipe open at both ends is partially submerged in water . A tuning fork is unknown frequency is placed near the top of the pipe and made to vibrate . The pipe can be moved up and down and thus length of air column the pipe can be adjusted. For definite lengths of air column in the pipe, standing waves will be set up as a result of superposition of sound waves travelling in opposite directions. Smallest value of length of air column , for which sound intensity is maximum is $10cm$[take speed of sound , $v = 344m/s$].

Answer the following questions.

Length of air column for third resonance will be

A. 30cm

B. 45cm

C. 20cm

D. 50cm

Answer: D

Watch Video Solution

9. A vertical pipe open at both ends is partially submerged in water . A tuning fork is unknown frequency is placed near the top of the pipe and made to vibrate . The pipe can be moved up and down and thus length of air column the pipe can be adjusted. For definite lengths of air column in the pipe, standing waves will be set up as a result of superposition of sound waves travelling in opposite directions. Smallest value of length of air column , for which sound intensity is maximum is $10cm$[take speed of sound , $v = 344m/s$].

Answer the following questions.

Frequency of the tuning fork is

A. 3400 Hz

B. 2500 Hz

C. 4300 Hz

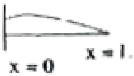
D. 1720 Hz

Answer: C

Watch Video Solution

PRACTICE SHEET ADVANCED (MATRIX MATCHING TYPE QUESTIONS)

1. Column I shows different sets of standing waves in a string of length L whose ends are fixed or free according to respective figure and Column - II shows possible equations for them where symbols have usual meaning

Column - I	Column - II
A) 	p) $y = A\sin\frac{\pi x}{L}\cos\omega t$
B) 	q) $y = A\sin\frac{2\pi x}{L}\cos\omega t$
C) 	r) $y = A\cos\frac{\pi x}{2L}\cos\omega t$
D) 	s) $y = A\cos\frac{\pi x}{L}\cos\omega t$

Watch Video Solution

PRACTICE SHEET ADVANCED (INTEGER TYPE QUESTIONS)

1. A source emitting sound of frequency 180 Hz is placed in front of a wall at a distance of 2 m from it. A detector is also placed in front of the wall at the same distance from it. Find the minimum distance between the source and the detector for which the detector detects a maximum of sound. Speed of sound in air $= 360 ms^{-1}$.

Watch Video Solution

2. A sonometer wire under tension of 64 N vibrating in its fundamental mode is in resonance with a vibrating tuning fork. The vibrating portion of the sonometer wire has a length of 10 cm and mass of 1 g. The vibrating tuning fork is now moved away from the vibrating wire with a constant speed and an observer standing near the sonometer hears one beat per second. Calculate the speed with which the tuning fork is moved, if the speed of sound in air is 300 m/s.

Watch Video Solution

3. Two radio stations broadcast their programs at the same amplitude A, and at slightly different frequencies ω_1 and ω_2 respectively, where ω_2 - ω_1 = $10^3 Hz$. A detector receives the signals from the two stations simultaneously. It can detect signals only of intensity $\geq 2A^2$.

(i) Find the time intervals between successive maxima of the intensity of the signal received by the detector

(ii) Find the time for which the detector remains idle in each cycle of the intensity of the signal

Watch Video Solution

4. A cylinder of length $1m$ is divided by a thin perfectly flexible diaphragm in the middle. It is closed by similar flexible diaphragams at the ends. The two chambers into which it is divided contain hydrogen and oxygen. The two diaphragms are set in vibrations of same frequency. What is the minimum frequency of these diaphragms for which the middle diaphragm will be motionless? Velocity of sound in hydrogen is $1100 m/s$ and that in oxygen is $300 m/s$.

Watch Video Solution

5. A train approaching a hill at a speed of 40 km/h sounds a whistle of frequency 580 Hz when it is at a distance of 1 km from the hill. A wind with a speed of 40 km/h is blowing in the direction of motion of the train. Find the frequency of the whitle as heard by an observer on the hill.

Watch Video Solution

6. A source of sound of frequency 1.8 kHz moves uniformly along a straight line at a distance 250 m from observer. The velocity of source is 0.8 C where C is the velocity of sound. Find out te frequency of sound received by observer (in kHz) at the moment when the source gets closest to him.

Watch Video Solution

7. A boy sitting on a swing which is moving to an angle of 30° from the vertical is blowing a whistle which has a frequency of 100 Hz. The whistle is at 2.0 m from the point of support of the swing. A girl stands in front of the swing. The maximum frequency she will hear is nearly 10^x Hz (velocity of sound 330 m/s,g= $9.8 m/s^2$). Find x

Watch Video Solution

8. A driver in a stationary car horns which produces sound waves having frequency 2000 Hz. The waves are directed normally towards a reflecting wall. If the wall approaches the car with a velocity u = 3.3

m/s. The change in the frequency of sound after reflection from the wall is x%. Then x

Watch Video Solution

9. A sonometer wire fixed at one end has a solid mass M hanging from its other end to produce tension in it. It is found that a 70cm length of wire produces a certain fundamental frequency when plucked. When the same mass M is hanging in water completely submerged in it, it is found that the length of the wire has to be changed by 5cm in order that it will produced the same fundamental frequency. The density of the material of mass M hanging from the wire is 7.26×10^{n} . Find n .

Watch Video Solution

10. A band playing music at a frequency f is moving towards a wall at a speed v_h. A motorist is following the band with a speed v_m. If v is the speed of sound, the expression for the beat frequency heard by the motorist is $\frac{n(V+V_m)V_b}{(V^2 - V_b^2)}$. Then n

Watch Video Solution

LECTURE SHEET (EXERCISE -I) (GENERAL WAVE EQUATIOIN) (LEVEL-I MAIN) (STRAIGHT OBJECTIVE TYPE QUESTIONS)

1. Which of the following expressions is that of a simpleharmonic progressive wave ?

A. $y = A\sin\omega t$

B. $y = A, \sin\omega t. \cos kx$

C. $y = A\sin(\omega t. x)$

D. $y = A\cos kx$

Answer: C

Watch Video Solution

2. The displacement y of a particle in a medium can be expressed as $y = -6\sin\left(100t + 20x + \frac{\pi}{4}\right)m$ where t is in seconds and x in metres. The speed of the wave is:

A. $2000ms^{-1}$

B. $5ms^{-1}$

C. $20ms^{-1}$

D. $5\pi ms^{-1}$

Answer: B

Watch Video Solution

3. The equation of a transverse wave travelling on a rope given by $y = 10\sin\pi(0.01x - 2.00t)$ whrer y and x are in cm and t in second .This maximum traverse speed of a particle in the rope is about

A. 62.8 cm/s

B. 75 cm/s

C. 100 cm/s

D. 121 cm/s

Answer: A

Watch Video Solution

4. A progressive wave moves with a velocity of 36m/s in a medium with a frequency of 200Hz. The phase difference between two particles seperated by a distance of 1cm is

A. 40 °

B. 20 rad

C. $\frac{\pi}{9}$ rad

D. $\frac{\pi}{9}$ degree

Answer: C

Watch Video Solution

LECTURE SHEET (EXERCISE -I) (GENERAL WAVE EQUATIOIN) (LEVEL-II ADVANCED) (STRAIGHT OBJECTIVE TYPE QUESTIONS)

1. The displacement of the particle at x = 0 of a stretched string carrying a wave in the positive x-direction is given by $f(t) = A\sin\left(\frac{t}{T}\right)$. The wave speed is v. Write the wave equation.

A. $f(x, t) = A\sin\left(\frac{t}{T} - \frac{x}{V}\right)$

B. $f(x, t) = A\sin\left(\frac{t}{T} + \frac{x}{VT}\right)$

C. $f(x, t) = A\sin\left(t + \frac{x}{VT}\right)$

D. $f(x, t) = A\sin\left(\frac{t}{T} - \frac{x}{VT}\right)$

Answer: D

Watch Video Solution

2. A pulse travelling on a string is represented by the function $y = \frac{a^3}{(x - vt)^2 + a^2}$ where a = 5 mm and v = 20 cm/s where the maximum of pulse is located at t = 0.1s and 2s. Take x = 0 in the middle of the string

A. x = 0, 20 cm and 40 cm

B. x = 20 m, 40 cm and 60 cm

C. x = 10 m, 20 cm and 30 cm

D. x = 4cm,.10 cm and 15 cm

Answer: A

Watch Video Solution

3. A motion is described by `y = 3e^x.e^(-3t) where y,x arc in metrd and t is in seconds.

A. This represents equation of progressive wave propagating along -x direction with $3ms^{-1}$

B. This represents equation of progressive wave propagating along +x direction with $3ms^{-1}$

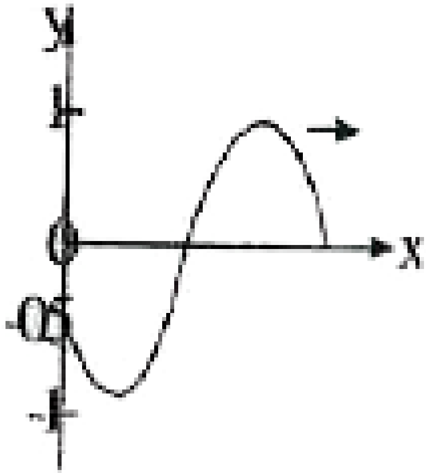
C. This does not represent a progressive wave equation.

D. Date is insufficient to arrive at any conclusion of this sort

Answer: C

Watch Video Solution

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



A. $1\sin\left(kx - \omega t + \frac{\pi}{6}\right)$

B. $1\sin\left(kx - \omega t - \frac{\pi}{6}\right)$

C. $1\sin\left(\omega t - kx + \frac{\pi}{6}\right)$

D. $1\sin\left(\omega t - kx - \frac{\pi}{6}\right)$

Answer: B

Watch Video Solution

5. A pulse is propagating on a long stretched string along its length taken as positive x-axis. Shape of the string at t = 0 is given by $y = \sqrt{a^2 - x^2}$when $|x| \le a = 0$ when $|x| \ge a$. What is the general equation of pulse after some time 't' , if it is travelling along positive x-direction with speed V?

A. $y(x, t) = \sqrt{a^2 - (x + Vt)^2}$, when $|x|Vt\ | \le a = x + Vt$ when $|x + Vt| \ge a$

B. $y(x, t) = \sqrt{a^2 + (x - Vt)^2}$, when $|x - Vt| \le a = a$, when $|x + Vt| \ge 0$

C. $y(x, t) = \sqrt{a^2 - (x - Vt)^2}$, when $|x - Vt| \le a = 0$, when $|x - Vt| \ge a$

D. $y(x, t) = \sqrt{a^2 + (x + Vt)^2}$, when $|x + Vt| \le a = a$, when $(x + Vt) \ge a$

Answer: C

Watch Video Solution

LECTURE SHEET (EXERCISE -I) (GENERAL WAVE EQUATIOIN) (LEVEL-II ADVANCED) (MORE THAN ONE CORRECT ANSWER TYPE QUESTIONS)

1. 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 $t = 2T$?

A. The speed of the wave is a/T.

B. The wave is travelling along negative x-axis

C. The maximum of the pulse located at t = T is x = -a

D. The maximum of the pulse located at t = 2T is x = -2a

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

Watch Video Solution

2. A wave $y = A\cos(\omega t - kx)$ passes through a medium. If V is the particle velocity and a is the particle acceleration then,

A. y,V and .a. all are in the same phase

B. y lags behind V by a phase angle of $\frac{\pi}{2}$

C. a. leads y by a phase angle of π

D. V. leads a by a phase angle of $\frac{3\pi}{2}$

Answer: B::C::D

Watch Video Solution

3. $y(x, t) = 0.8/\left[(4x + 5t)^2 + 5\right]$ represent a moving pulse, where x and y are in metres and t is in seconds, then

A. pulse is moving in +ve x direofibn

B. in 2s it will travel a distance of 2.5m

C. its maximum displacement is 0.16m

D. it is a symmetric pulse

Answer: B::C::D

Watch Video Solution

4. A plane progessive wave of frequency $25Hz$, amplitude $2.5 \times 10^{-5}m$ and initial phase zero propagates along the negative x-direction with a velocity of $300m/s$. At any instant, the phase difference between the oscillations at two points $6m$ apart the line of propagation is _____ .

A. A=0

B. $\phi = 0$

C. $A = 2.5 \times 10^{-5} m$

D. $\phi = \pi$

Answer: A::D

Watch Video Solution

LECTURE SHEET (EXERCISE -I) (GENERAL WAVE EQUATIOIN) (LEVEL-II ADVANCED) (LINKED COMPREHENSION TYPE QUESTIONS) (PASSAGE-I)

1. A travelling wave on a long stretched string along the positIve x-axis is given by $y = 5mme\left(\frac{T}{5s} - \frac{x}{5cm}\right)^2$. Using this equation answer the following questions.

The velocity of the wave is

A. 1 m/s

B. 5m/s

C. 1 cm/s

D. 1 mm/s

Answer: C

Watch Video Solution

2. A travelling wave on a long stretched string along the positIve x-axis is given by $y = 5mme\left(\frac{t}{5s} - \frac{x}{5cm}\right)^2$. Using this equation answer the following questions.

At t = 0, x = 0, the displacement of the wave is

A. 0

B. ∞

C. 5 mm

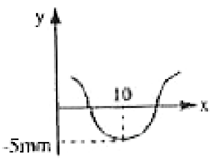
D. 10 mm

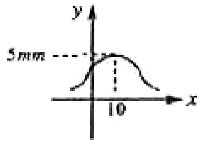
Answer: C

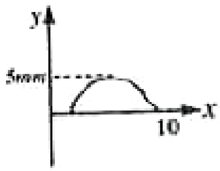
Watch Video Solution

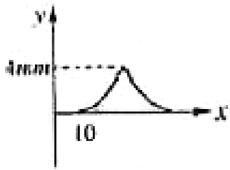
3. A travelling wave on a long stretched string along the positlve x-axis is given by $y = 5mme\left(\frac{T}{5s} - \frac{x}{5cm}\right)^2$. Using this equation answer the following questions.

The plot of y and x at t = 10 s is best indicated by

A. 

B. 

C. 

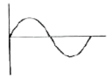
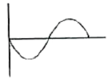
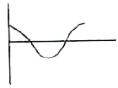
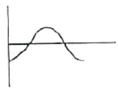
D. 

Answer: B

Watch Video Solution

LECTURE SHEET (EXERCISE -I) (GENERAL WAVE EQUATIOIN) (LEVEL-II ADVANCED) (MATRIX MATCHING TYPE QUESTIONS)

1. Symbols have their usual meanings. Match the Column-I with Column-II:

Column-I	Column-II
A) String slope versus time t at $x = 0$ for $y = A\sin(kx + \omega x)$	p) 
B) Instantaneous velocity of particle versus time t at $x = 0$ for $y = A\sin(kx - \omega x)$	q) 
C) Displacement of particle versus time t at $x = 0$ for $s = s_0 \sin(\omega t - kx)$	r) 
D) Displacement of particle versus time t at $x = 0$ for $p = p_0 \cos(kx - \omega t)$ where p represents pressure variation.	s) 

Watch Video Solution

LECTURE SHEET (EXERCISE -II) (WAVE SPEED, ENERGY, POWER & INTENSITY AND SUPERPOSITION PRINCIPLE) (LEVEL-I MAIN)(STRAIGHT OBJECTIVE TYPE QUESTIONS)

1. Two strings A and B, made of the same material, have equal lengths. The cross sectional area of A is half that of B while the tension on A is twice that on B. The ratio of the velocities of transverse waves in A and B is

A. $\sqrt{2} : 1$

B. $1:\sqrt{2}$

C. $2:1$

D. $1:2$

Answer: C

Watch Video Solution

2. The density of the stretched string is changed by 2% without change in tension and radius. The change in transverse wave velocity.

A. 2% increase

B. 1% increase

C. 1% increase or decrease

D. 4% change

Answer: C

Watch Video Solution

3. 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. $v/\sqrt{2}$

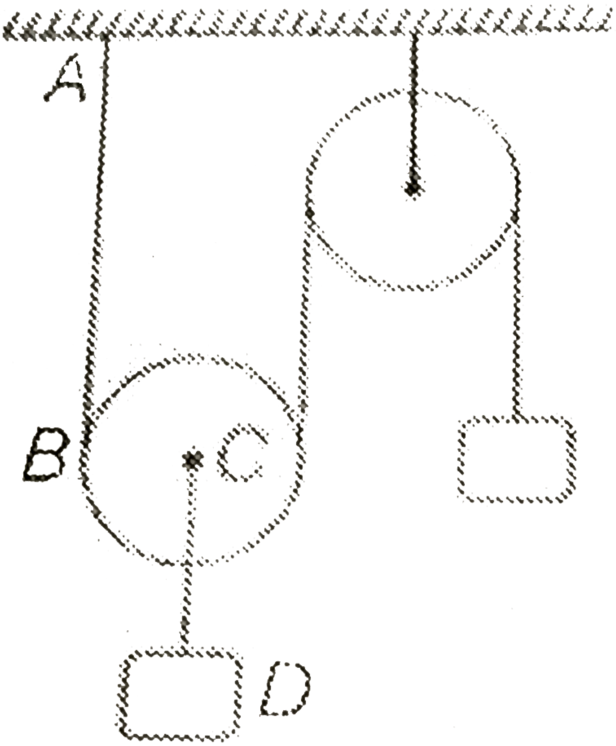
C. $\sqrt{2}v$

D. 4v

Answer: C

Watch Video Solution

4. 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

5. A wire of length L, is hanging vertically from a rigid support. If a transverse wave pulse is generated at the free end of wire then which of the following statement is wrong

A. Velocity at bottom end is zero

B. Velocity at top end is $\sqrt{gL}$

C. Time taken of reach the top end is $2\sqrt{\frac{L}{g}}$

D. Acceleration of wave is g.

Answer: D

Watch Video Solution

6. The mass of a 10 m long wire is 100 grams. If a tension of 100 N is applied, calculate the time taken by a transverse wave to travel from one end to the other end of the wire.

A. 0.5 s

B. 0.1 s

C. 2 s

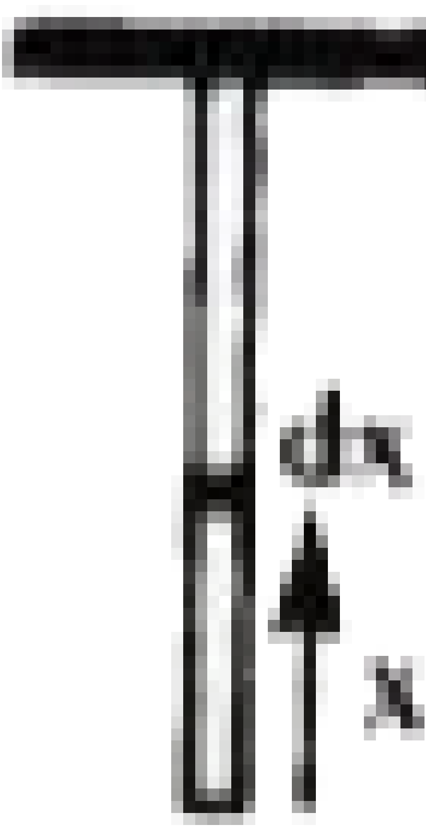
D. 2.5 s

Answer: B

Watch Video Solution

LECTURE SHEET (EXERCISE -II) (WAVE SPEED, ENERGY, POWER & INTENSITY AND SUPERPOSITION PRINCIPLE) (LEVEL-II ADVANCED) (STRAIGHT OBJECTIVE TYPE QUESTIONS)

1. A wire of variable mass per unit length $\mu = \mu_0 x$, is hanging from the ceiling as shown in figure. The length of wire is l_0 . A small transverse disturbance is produced at its lower end. Find the time after which the disturbance will reach to the other ends.



A. $\sqrt{\frac{6l_0}{g}}$

B. $\sqrt{\frac{8l_0}{g}}$

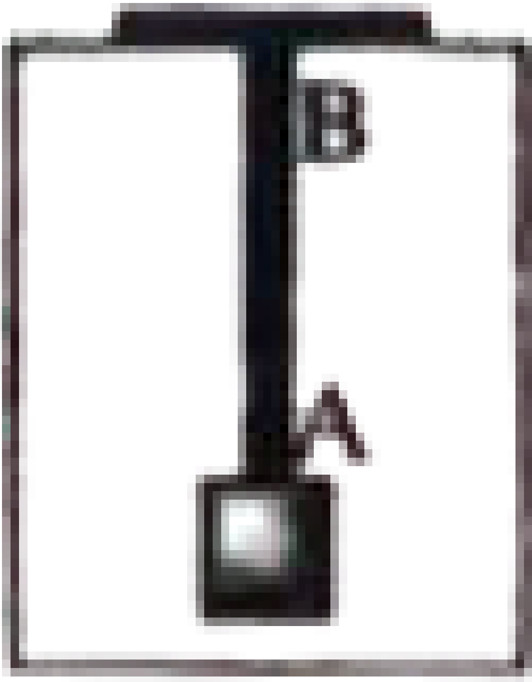
C. $\sqrt{\frac{9l_0}{g}}$

D. $\sqrt{\frac{10l_0}{g}}$

Answer: B

Watch Video Solution

2. A block of mass M is attached with a string of mass m and length l as shown in figure. The whole system is placed on a planet whose mass and radius is three times the mass and radius of earth. Find the ratio of maximum and minimum velocity of wave pulse. Assume the acceleration due to gravity on the earth to be g.



A. $\frac{V_{max}}{V_{min}} = \sqrt{1 + \frac{m}{M}}$

B. $\frac{V_{max}}{V_{min}} = \sqrt{1 + \frac{M}{m}}$

C. $\frac{V_{max}}{V_{min}} = \sqrt{\frac{M - m}{m}}$

D. $\frac{V_{max}}{V_{min}} = \sqrt{\frac{M}{M - m}}$

Answer: A

Watch Video Solution

3. A wave pulse starts propagating in the x direction along a non uniform wire of length 10m with mass per unit length is given by $\mu = \mu_0 + ax$ and under a tension of 100N. The time taken by a pulse to travel from the lighter end to heavier end $\left(\mu_0 = 10^{-2} kg/m \text{ and } a = 9 \times 10^{-3} kg/m^2\right)$ is

A. 22.27 sec

B. 2.27 sec

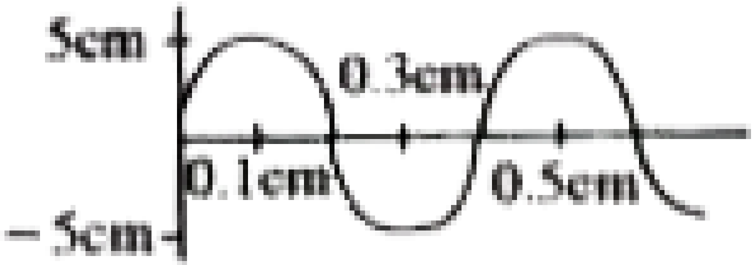
C. 0.227 sec

D. 0.0227 sec

Answer: C

Watch Video Solution

4. Figure shows the shape of part of a long string in which transverse waves are produced by attaching one end of the string to tuning fork of frequency 250 Hz. What is the velocity of the waves?



A. $1.0ms^{-1}$

B. $1.5ms^{-1}$

C. $2.0ms^{-1}$

D. $2.5ms^{-1}$

Answer: A

Watch Video Solution

5. A wire of $9.8 \times 10^{-3} k\frac{g}{m}$ passes over a frictionless light pulley fixed on the top of a frictionless inclined plane which makes an angle of 30° with the horizontal. Masses m and M are tied at the two ends of wire such that m rests on the plane and M hangs freely vertically downwards. the entire system is in equilibrium and a transverse wave propagates along the wire with a velocities of $100 m/s$.

A. M = 5 kg

B. $\frac{m}{M} = \frac{1}{4}$

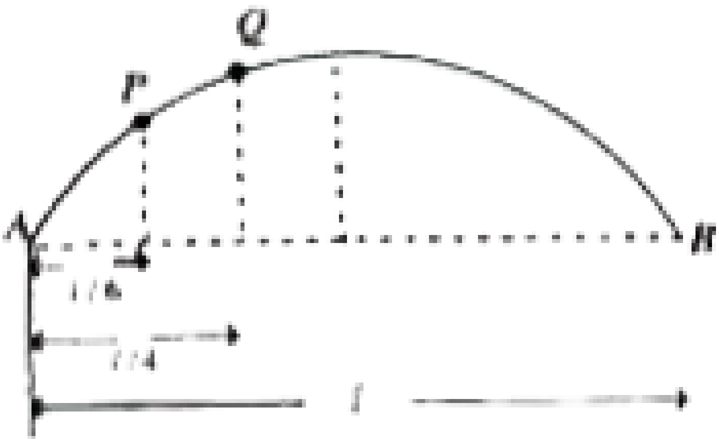
C. m = 20 kg

D. $\frac{m}{M} = 4$

Answer: C

Watch Video Solution

6. A string vibrates with one loop between the fixed points A and B. The ratio of magnitudes of maximum velocities of P and Q is [The shape of string when P and Q having zero speeds as shown in the figure].



A. $2:3$

B. $1:\sqrt{2}$

C. $1:\sqrt{3}$

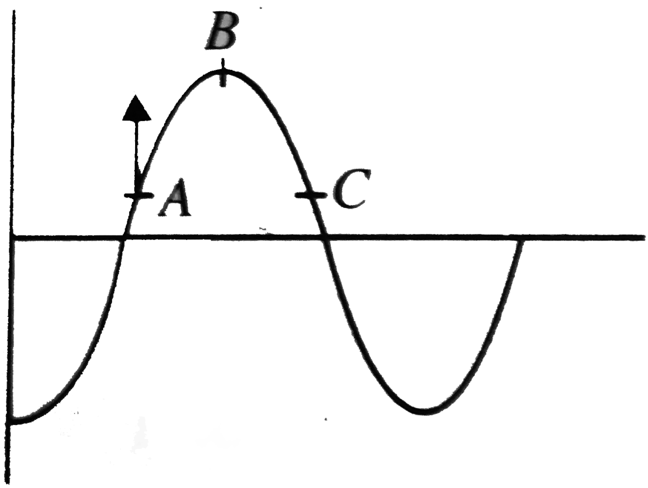
D. None

Answer: B

Watch Video Solution

LECTURE SHEET (EXERCISE -II) (WAVE SPEED, ENERGY, POWER & INTENSITY AND SUPERPOSITION PRINCIPLE) (LEVEL-II ADVANCED) (MORE THAN ONE CORRECT ANSWER TYPE QUESTIONS)

1. A wave is travelling along a string. At an instant shape of the string is as shown in the enclosed figure. At this instant, point A is moving upwards. Which of the following statements are correct?



A. The wave is travelling to the right

B. Displacement amplitude of the wave is equal to the displcement of B at this instant

C. At this instant velocity of C is also directed upwards

D. Phase difference between A and C may be equal to $\pi/2$ if $x = \lambda/4$

Answer: B::D

Watch Video Solution

2. A transverse wave is travelling on a string. The equation of the wave

A. is the general equation for displacementof a particle of the string at any instant.t..

B. is the equation of the shape of the string at any instant t.

C. must have sinusoidal form

D. is an equation of displacement for the particle at any one end at a particular time .t..

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

Watch Video Solution

3. The energy per unit area associated with a progressive sound wave will be doubled if

A. the amplitude of the wave is doubled

B. the amplitude of the wave is increased by 50%

C. the amplitude of the wave is increased by 43%

D. the frequency of the wave is increased by 43%

Answer: C::D

Watch Video Solution

4. A uniform rope of mass M length L hangs vertically from the ceiling, with lower end free. A distbance on the rope trvelling upwards starting from the lower end has a velocity v. At a point P at distance x from the lower end.

A. Tension at point P is mg

B. $v = \sqrt{xg}$

C. $v = \sqrt{2xg}$

D. Tension at point P is $\left(\frac{M}{L}\right)xg$

Answer: B::D

Watch Video Solution

LECTURE SHEET (EXERCISE -II) (WAVE SPEED, ENERGY, POWER & INTENSITY AND SUPERPOSITION PRINCIPLE) (LEVEL-II ADVANCED) (INTEGER TYPE QUESTIONS)

1. A loop of a string of mass length μ and redius R is rotated about an axis passing through centre perpendicular to the plane with an angular velocity ω.A small disturbance is created in the loop having the same sense of rotation. The linear speed of the disturbance observer is

Watch Video Solution

2. The diameter of a stretched string is increased 3%, keeping the other parameters constant then the velocity is x% decreases what is the value of x ?

Watch Video Solution

3. A flexible steel cable of total length 'L' and mass per unit length H hangs vertically (under it's own weight) from a support at upper end. If transverse pulse starts to move down in the wire from its support. The ratio of acceleration of the pulse at distance L/4 from the support end to the acceleration of the of the pulse at distance L/2 from the support end K:1 then the value of K is

Watch Video Solution

LECTURE SHEET (EXERCISE -III) (REFLECTION, TRANSMISSION OF WAVES AND STANDING WAVES) (LEVEL-I MAIN) (STRAIGHT OBJECTIVE TYPE QUESTIONS)

1. The length of a string attached to two rigid supports is 40 cm. The maximum wavelength in cm of a stationary wave produced on it is :

A. 20 cm

B. 80 cm

C. 40 cm

D. 120 cm

Answer: B

Watch Video Solution

2. The length of a sonometer wire AB is 100 cm, where should the two bridges be placed from A to divide the wire in 3 segments whose fundamental frequencies are in the ratio of 1:2:6

A. 30 cm, 90 cm

B. 30 cm, 90 cm

C. 40 cm, 80 cm

D. 20 cm, 30 cm

Answer: B

Watch Video Solution

3. When the tension in a string is increased by 44%. the frequency increased by 10Hz the frequency of the string is

A. 100 Hz

B. 200 Hz

C. 150 Hz

D. 50 Hz

Answer: D

Watch Video Solution

4. To increase the frequency by 20 % ,the tension in the string vibrating on a sonometer has to be increased by

A. 0.44

B. 0.33

C. 0.22

D. 0.11

Answer: A

Watch Video Solution

5. The ends of a stretched wire of length L are fixed at x = 0 and x = L, In one experiment, the displacement of wire is $y_1 = A\sin(\pi x / L)\sin\omega t$ and energy is E_1 and in another experiment its displacement is $y_2 = A\sin(2\pi x / L)\sin 2\omega t$ and energy is E_2. Then

A. $E_2 = E_1$

B. $E_2 = 2E_1$

C. $E_2 = 4E_1$

D. $E_2 = 16E_1$

Answer: C

Watch Video Solution

6. Transverse waves are generated in two uniform wires A and B of the same material by attaching their free ends to a vibrating source of frequency 200 Hz. The Area of cross section of A is half that of B while tension on A is twice than on B. The ratio of wavelengths of the transverse waves in A and B is

A. $1:\sqrt{2}$

B. $\sqrt{2}:1$

C. $1:2$

D. $2:1$

Answer: D

Watch Video Solution

7. A somoneter wire resonates with a given tuning fork forming standing waves with five antindoes between the two bridges when a mass of 9 kg is suspended from the wire. Resonates with the same tuning fork forming three antindoes for the same postions of the bridges. the value of M is

A. 25 kg

B. 5 kg

C. 12.5 kg

D. $1/25$ kg

Answer: A

Watch Video Solution

8. Two vibrating strings of the same material but lengths L and 2L have radii 2 r and r respectively. They are strectched under the same tension. Both the strings vibrate in their fundamental modes, the one of length L with frequency n_1 and the other with frequency n_2. The ratio n_1/n_2 is given by

2

4

8

1

A. 2

B. 4

C. 8

D. 1

Answer: D

Watch Video Solution

9. An object of specific gravity ρ is hung from a thin steel wire. The fundamental frequency for transverse standing waves in the wire is 300 Hz. The object is immersed in water, so that one half of its volume is submerged . The new fundamental frequency (in Hz) is

(a) $300\left(\frac{2\rho - 1}{2\rho}\right)^{\frac{1}{2}}$

(b) $300\left(\frac{2\rho}{2\rho - 1}\right)^{\frac{1}{2}}$

(c) $300\left(\frac{2\rho}{2\rho - 1}\right)$

(d) $300\left(\frac{2\rho - 1}{2\rho}\right)$

A. $300\left(\frac{2\rho - 1}{2\rho}\right)^{1/2}$

B. $300\left(\frac{2\rho}{2\rho - 1}\right)^{1/2}$

C. $300\left(\frac{2\rho}{2\rho - 1}\right)$

D. $300\left(\frac{2\rho - 1}{2\rho}\right)$

Answer: A

Watch Video Solution

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

A. $a\sin(kx + \omega t)$

B. $-a\cos(kx - \omega t)$

C. $-a\cos(kx + \omega t)$

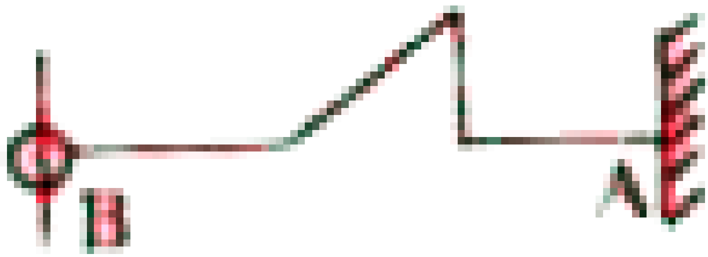
D. $-a\sin(kx - \omega t)$

Answer: C

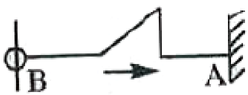
Watch Video Solution

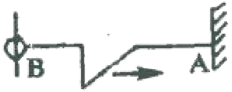
LECTURE SHEET (EXERCISE -III) (REFLECTION, TRANSMISSION OF WAVES AND STANDING WAVES) (LEVEL-II ADVANCED) (STRAIGHT OBJECTIVE TYPE QUESTIONS)

1. A pulse shown here is reflected from the rigid wall A and then from free end B. The shape of the string after these 2 reflection will be



A. 

B. 

C. 

D. 

Answer: A

Watch Video Solution

2. A long wire PQR is made by joining two wires PQ and QR of equal radii. PQ has a length 4.8m and mass 0.06 kg. QR has length 2.56 m and mass 0.2 kg. The wire PQR is under a tension of 80N. A sinusoidal wave pulse of amplitude 3.5 cm is sent along the wire PQ from the end P. No power is dissipated during the propagation of the wave pulse. Calculate:

(a) The time taken by the wave pulse to reach the other end R.

(b) The amplitude of the reflected and transmitted wave pulse after the incident wave pulse crosses the joint Q.

A. 0.14 s, 1.5 cm, 2 cm

B. 0.3 s, 1.2 cm, 2 cm

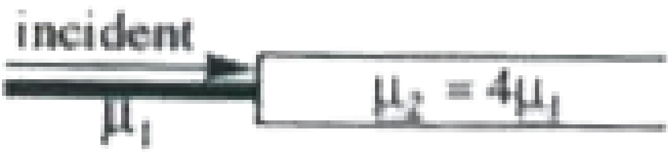
C. 0.4 s, 1.3 cm, 1 cm

D. 0.2 s, 1.1 cm, 3 cm

Answer: A

Watch Video Solution

3. String-1 is connected with string-2. The mass per unit length in string-1 is μ_1 and the mass per unit length in string-2 is $4\mu_1$. The tension in the strings is T. A travelling wave is coming from the left. What fraction of the energy in the incident wave goes into string-2 ?



A. $1/8$

B. $4/9$

C. $2/3$

D. $8/9$

Answer: B

Watch Video Solution

4. A steel wire of length 1 m, mass 0.1 kg and uniform cross-sectional area $10^{-6}m^2$ is rigidly fixed at both ends. The temperature of wire is lowered by 20°C. If transverse waves are set up by plucking the string in the middle, calculate the frequency (In S.I. units) of the fundamental mode of vibration. Young's modulus of steel $= 2 \times 10^{11} N/m^2$, coefficient of linear expansion of steel $= 1.21 \times 10^{-6}(degC)^{-1}$.

A. 21 Hz

B. 31 Hz

C. 11 Hz

D. 1 Hz

Answer: C

Watch Video Solution

5. A standing wave is maintained in a homogeneous string of cross-sectional area s and density ρ . It is formed by the superposition of two waves travelling in opposite directions given by the equation $y_1 = a\sin(\omega t - kx)$ and $y_2 = 2a\sin(omegt + kx)$. The total mechanical energy confined between the sections corresponding to the adjacent antinodes is

A. $\dfrac{3\pi\rho\omega^2 a^2}{2k}$

B. $\dfrac{\pi s\rho\omega^2 a^2}{2k}$

C. $\dfrac{5\pi\rho\omega^2 a^2}{2k}$

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

Answer: C

Watch Video Solution

6. A somoneter wire resonates with a given tuning fork forming standing waves with five antindoes between the two bridges when a mass of 9 kg is suspended from the wire. Resonates with the same tuning fork forming three antindoes for the same postions of the bridges. the value of M is

A. 25 kg

B. 5 kg

C. 12.5 kg

D. $\frac{1}{25}$ kg

Answer: A

Watch Video Solution

7. A wave represented by the equation y = a cos(kx - wt) is superposed with another wave to form a stationary wave such that point x= 0 is a node. The equation for the other wave is

A. $a\sin(kx + \omega t)$

B. $-a\cos(kx - \omega t)$

C. $-a\cos(kx + \omega t)$

D. $-a\sin(kx - \omega t)$

Answer: C

Watch Video Solution

LECTURE SHEET (EXERCISE -III) (REFLECTION, TRANSMISSION OF WAVES AND STANDING WAVES) (LEVEL-II ADVANCED) (MORE THAN ONE CORRECT ANSWER TYPE QUESTIONS)

1. Standing waves can be produced.

A. on a string clamped at both ends

B. on a string clamped at one end and free at the other

C. when incident wave gets reflected,.from a wall

D. when two identical waves with a phase difference of . n. are moving in the same direction

Answer: A::B::C

Watch Video Solution

2. The (x, y) co-ordinates of the corners of a square plate are $(0, 0)$, (L, L) and $(0, L)$. The edges of the plate are clamped and transverse standing waves are set up in it. If $u(x, y)$ denotes the displacement of the plate at the point (x, y) at some instant of time, the possible expression (s) for u is (are) $(a = positiveconstant)$

A. $a\cos(\pi x/2L)\cos(\pi y/2L)$

B. $a\sin(\pi x/L)\sin(\pi y/L)$

C. $a\sin(\pi y/L)\sin(2\pi y/L)$

D. $a\cos(2\pi x/L)\sin(\pi y/L)$

Answer: B::C::D

Watch Video Solution

3. A wave disturbance in a medium is described by y(x,t) = 0.02 cos $\left(50\pi t + \frac{\pi}{2}\right)\cos(10\pi x)$, where x and y are in meter and t is in second.

A. A node occurs at x = 0.15m

B. An antinode occurs at x = 0.3m

C. The speed of wave is $5ms^{-1}$

D. he wavelength of wave is 0.2m

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

Watch Video Solution

LECTURE SHEET (EXERCISE -III) (REFLECTION, TRANSMISSION OF WAVES AND STANDING WAVES) (LEVEL-II ADVANCED) (LINKED COMPREHENSION TYPE QUESTIONS) (PASSAGE-I)

1. The displacement of a medium in a sound wave is given by the equation $y_1 = A\cos(ax + bt)$ where A, a and b are positive constants. The wave is reflected by an obstacle situated at x=0. the intensity of the reflected wave is 0.64 times that of the incident wave.

(i) What are the wavelength and frequency of incident wave ? _______

(ii) Write the equation for the reflected wave. ________ (iii) In the resultant wave formed after reflection, find the maximum and minimum values of the particle speeds in the medium. ___________ (iv) Express the resultant wave as a superposition of a standing wave and a traveling wave. What are the positions of the antinodes of the standing wave ? What is the direction propagation of traveling wave?_________

A. $y = 0.8A\cos(bt - ax)$

B. $y = 0.4\sin(bt - ax)$

C. $y = -0.8A\cos(bt - ax)$

D. $y = 0.4A\sin(bt + ax)$

Answer: C

Watch Video Solution

2. The displacement of a medium in a sound wave is given by the equation $y_1 = A\cos(ax + bt)$ where A, a and b are positive constants. The wave is reflected by an obstacle situated at x=0. the intensity of the reflected wave is 0.64 times that of the incident wave.

(i) What are the wavelength and frequency of incident wave ? _______

(ii) Write the equation for the reflected wave. ________ (iii) In the resultant wave formed after reflection, find the maximum and minimum values of the particle speeds in the medium. __________ (iv) Express the resultant wave as a superposition of a standing wave and a traveling wave. What are the positions of the antinodes of the standing wave ? What is the direction propagation of traveling wave?_________

A. $V_{max} = 1.8Ab, V_{min} = 0Ab$

B. $V_{\max} = 0.9Ab, V_{\min} = 0.1Ab$

C. $V_{\max} = 1.1Ab, V_{\min} = 0.1Ab$

D. $V_{\max} = 1Ab, V_{\min} = 0.5Ab$

Answer: A

Watch Video Solution

3. Two wires 1 and 2 of the same cross sectional area $A = 10mm^2$ and the same length but made of different materials are welded together and their ends are rigidly clamped between two walls, as shown in figure. The respective young's moduli and coefficient of linear expansions are $y_1 = 10^9 N/m^2, y_2 = 2 \times 10^9 N/m^2, \alpha_1 = 6 \times 10^{-4}\,^\circ C^{-1}, \alpha_2 = 3 \times 10^{-4}\,^\circ C^{-1}$. if temperature of system reduced by $20\,^\circ$C then

Find the displacement of the joint

A. 0

B. 10 cm

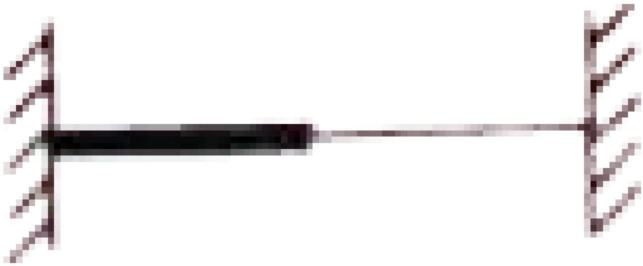
C. 5 cm

D. 2 cm

Answer: A

Watch Video Solution

4. Two wires 1 and 2 of the same cross sectional area $A = 10mm^2$ and the same length but made of different materials are welded together and their ends are rigidly clamped between two walls, as shown in figure. The respective young's moduli and coefficient of linear expansions are $y_1 = 10^9 N/m^2, y_2 = 2 \times 10^9 N/m^2, \alpha_1 = 6 \times 10^{-4} {}^\circ C^{-1}, \alpha_2 = 3 \times 10^{-4} {}^\circ C^{-1}$. if temperature of system reduced by 20° C then



Find the displacement of the joint

A. 20 Hz

B. 40 Hz

C. 60 Hz

D. 100 Hz

Answer: B

Watch Video Solution

5. Match the following:

Column - I	Column - II
A) A vertical rod is hit vertically	p) pressure wave
B) A vertical rod is hit horizontally	q) transverse wave
C) A cylindrical tube having a gas is vibrated by a tuning fork	r) Displacement wave
D) Ripples on water surface	s) longitudinal wave

Watch Video Solution

6. A sinusoidal plane wave falls on a partially rigid boundary of reflection coefficient 0.36. Consider the location of the boundary at x = 0. Let the equation of incident wave be $y_1 = a\sin(\omega t - kx)$. then

Column - I	Column - II
A) Ratio of intensities of reflected wave and of transmitted wave is :	p) 9 : 16
B) Ratio of amplitude of reflected wave and of transmitted wave is :	q) $0.6a\sin(\omega t + kx + \pi)$
C) Equation of reflected wave is :	r) Zero
D) Phase difference between the incident wave and transmitted wave at x = 0 is :	s) 3 : 4

Watch Video Solution

LECTURE SHEET (EXERCISE -III) (REFLECTION, TRANSMISSION OF WAVES AND STANDING WAVES) (LEVEL-II ADVANCED) (LINKED COMPREHENSION TYPE QUESTIONS) (PASSAGE-II)

1. Two wires 1 and 2 of the same cross sectional area $A = 10mm^2$ and the same length but made of different materials are welded together and their ends are rigidly clamped between two walls, as shown in figure. The respective young's moduli and coefficient of linear expansions are $y_1 = 10^9 N/m^2, y_2 = 2 \times 10^9 N/m^2, \alpha_1 = 6 \times 10^{-4} \,^\circ C^{-1}, \alpha_2 = 3 \times 10^{-4} \,^\circ C^{-1}$. if temperature of system reduced by $20\,^\circ$C then

Find the displacement of the joint

A. 80

B. 10 N

C. 120 N

D. 140 N

Answer: C

Watch Video Solution

LECTURE SHEET (EXERCISE -III) (REFLECTION, TRANSMISSION OF WAVES AND STANDING WAVES) (LEVEL-II ADVANCED)(INTEGER TYPE QUESTIONS)

1. The displacement of a particle in a periodic motion is given by $y = 4\cos^2(t/2)\sin(1000t)$. This displacement may be considered as the result superposition of n independent harmonic oscillations. Here , n is

Watch Video Solution

2. A point (sound generating) source of power 6.5 milli watts, is placed at the centre of the hollow cylinder of length 24cm and its radius of cross-section 5cm. Then the power passing through the lateral surface of the cylinder in milli watts is

Watch Video Solution

LECTURE SHEET (EXERCISE -IV) (SPEED OF SOUND, INTENSITY OF SOUND, INTERFERENCE OF SOUND WAVES) (LEVEL-I MAIN) (STRAIGHT OBJECTIVE TYPE QUESTIONS)

1. The temperature at which the speed of sound in air becomes double of its value at $27^{\circ} C$ is

A. 273 K

B. 546 K

C. 1092 K

D. 0 K

Answer: C

Watch Video Solution

2. The velocities of sound at the same temperature in two monoatomic gases of densities ρ_1 and ρ_2 are v_1 and v_2 respectively. If $\rho_1 / \rho_2 = 4$, then value of v_1 / v_2 is

A. $1:2$

B. $4:1$

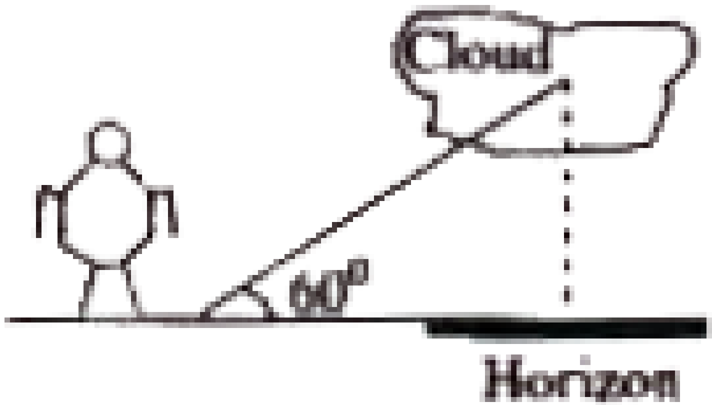
C. $2:1$

D. $1:4$

Answer: C

Watch Video Solution

3. The elevation of a cloud is 60° above the horizon. A thunder is heard 8s after the observation of lighting. The speed of sound is 330 ms^{-1} The vertical height of cloud form ground is



A. 2826 m

B. 2682 m

C. 2286 m

D. 2068 m

Answer: C

Watch Video Solution

4. the minimum distance between the reflecting surface and source for listening the eco of sound is (take speed of sound $340\frac{m}{s}$)

A. 16.5 m

B. 17 m

C. 18 m

D. 16 m

Answer: B

Watch Video Solution

5. A car is moving with a speed of 72 kmph towards a hill. Car blows horn at a distance of 1800 m from the hill. If echo is heard after 10 seconds, the speed of sound (in m/sec) is

A. 300

B. 320

C. 340

D. 360

Answer: C

Watch Video Solution

6. The faintest sound the human ear can detect at a frequency of 1kHz (for which the ear is most sensitive) corresponds to an intensity of about $10^{-12} W/m^2$ (the so called threshold of hearing). Determine the pressure amplitude and maximum displacement associated with this sound assuming the density of air = $1.3 kg/m^2$ and velocity of sound in air = 332 m/s

A. $2.94 \times 10^{-5} N/m^2, 1.1 \times 10^{-11} m$

B. $2.94 \times 10^{-4} N/m^2, 1.3 \times 10^{-11}$m

C. $2.94 \times 10^{-1} N/m^2, 1.2 \times 10^{-11}$m

D. $2.94 \times 10^{-3} N/m^2, 1.5 \times 10^{-11}$ m

Answer: A

Watch Video Solution

7. The speaker of a public address system emits 20 kW power, considering it a point source. What is the sound intensity level at a point 4.00 m away?

A. 100 dB

B. 140 dB

C. 120 dB

D. 125 dB

Answer: B

Watch Video Solution

8. A plane longitudinal wave having angular frequency ω = 500 rad /sec is travelling in positive x-direction in a medium of density ρ =1 kg/m and bulk modulus $4 \times 10^4 N/m^2$. The loudness at a point in the medium is observed to be 20 dB. Assuming at x = 0 initial phase of the medium particles to be zero, find the equation of the wave

A. $y = 2 \times 10^{-9} \sin\left(500t - \frac{5x}{2}\right)$

B. $y = 3 \times 10^{-9} \sin\left(500t + \frac{5x}{2}\right)$

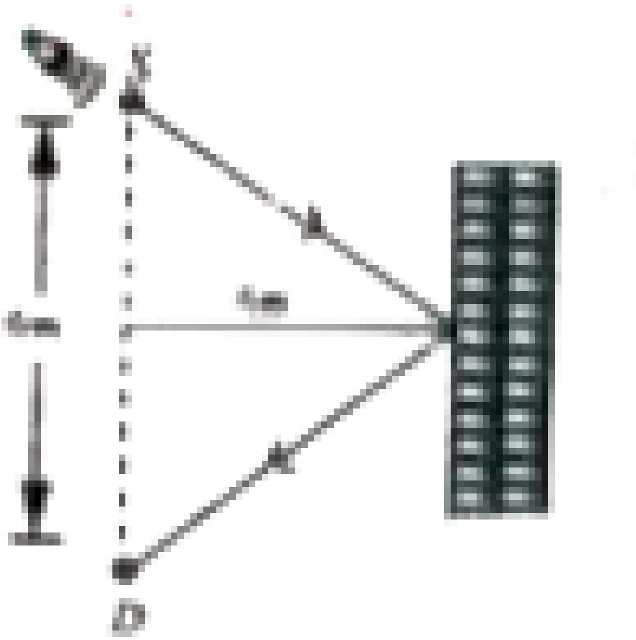
C. $y = 3 \times 10^{-9} \sin\left(500t + \frac{5x}{2}\right)$

D. $y = 2 \times 10^{-9} \sin\left(5000t - \frac{5x}{2}\right)$

Answer: A

Watch Video Solution

9. A person standing at a distance of 6 m from a source of sound receives sound wave in two ways, one directly from the source and other after reflection from a rigid boundary as shown in the figure. The maximum wavelength for which, the person will receive maximum sound intensity, is



A. 4 m

B. $\frac{16}{3}$ m

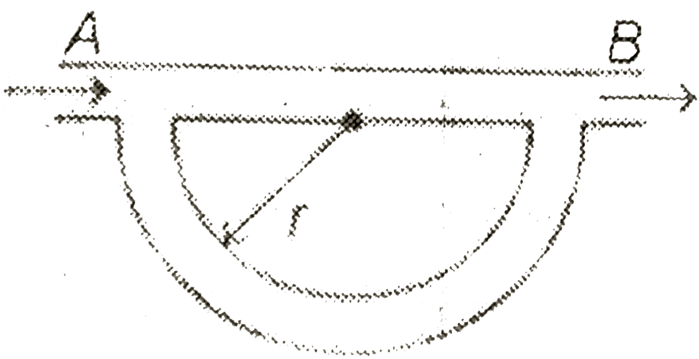
C. 2 m

D. $\frac{8}{3}$ m

Answer: A

Watch Video Solution

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

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

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

Answer: B

Watch Video Solution

11. Two sources S_1 and S_2, each emitting waves of wavelength λ are kept symmetrically on either side of centre o of a circle ABCD such that $S_1O = S_2O = 2\lambda$. If a detector is moved along the circumference of the circle, it will record how many maximum in one revolution

A. 8

B. 12

C. 16

D. 24

Answer: A

Watch Video Solution

LECTURE SHEET (EXERCISE -IV) (SPEED OF SOUND, INTENSITY OF SOUND, INTERFERENCE OF SOUND WAVES) (LEVEL-II ADVANCED) (STRAIGHT OBJECTIVE TYPE QUESTIONS)

1. A sample of oxygen at NTP has volume V and a sample of hydrogen at NTP has the volume 4V. Both the gases are mixed. If the speed of sound in hydrogen at NTP is 1270 m/s, that in mixture is

A. 317 m/s

B. 635 m/s

C. 830 m/s

D. 950 m/s

Answer: B

Watch Video Solution

2. A soldier walks towards a high wall taking 120 steps per minute. When he is at a distance of 90 m from the wall he observes that echo of step coincides with the next step. The speed of sound must be

A. 340 m/s

B. 330 m/s

C. 300 m/s

D. 360 m/s

Answer: D

Watch Video Solution

3. A mixture of two diatomic gases exists in a closed cylinder. The volumes and velocities of sound in the two gases are $V_1, V_2, c_1$and c_2 respectively. Determine the velocity of sound in the gaseous mixture. (Pressure of gas remains constant),

A. $c_1c_2\sqrt{\dfrac{V_1 + V_2}{V_1c_2^2 + V_2c_1^2}}$

B. $c_2c_1\sqrt{\dfrac{V_2^2 + V_1^2}{V_1C_2^2 + V_2c_1^2}}$

C. $c_2c_1\sqrt{\dfrac{V_2 - V_1}{V_1c_2^2 - V_2c_1^2}}$

D. $c_1c_2\sqrt{\dfrac{V_2 + V_1}{V_1c_1^2 - V_2c_2^2}}$

Answer: A

Watch Video Solution

4. Assume that temperature varies linearly with height near the Earth's surface. Considering temperature at the surface of the Earth T_1 and T_2 at a height h above the surface, calculate the time t needed for a sound wave produced at a height. x. to reach the Earth's surface. Velocity of sound at the Earth's surface is c.

A. $t = \frac{2h}{c}\frac{\sqrt{T_1}}{T_2 - T_1}\left[\sqrt{T_1} - \sqrt{\frac{T_2 - T_1}{h} \times + T_1}\right]$

B. $t = \frac{2h}{c}\frac{\sqrt{T_1}}{T_1 - T_2}\left[\sqrt{T_1} - \sqrt{\frac{T_2 - T_1}{h} \times + T_1}\right]$

C. $t = \frac{3h}{c}\frac{\sqrt{T_1}}{T_2 - T_1}\left[\sqrt{T_1} - \sqrt{\frac{T_2 - T_1}{h} \times + T_1}\right]$

D. $t = \frac{6h}{c}\frac{\sqrt{T_1}}{T_2 - T_1}\left[\sqrt{T_1} - \sqrt{\frac{T_2 - T_1}{h} x \times T_1}\right]$

Answer: B

Watch Video Solution

5. A dog while barking delivers about 1 mW of power. If this power is uniformly distributed over a hemispherical area, what is the sound level at a distance of 5 m? What would the sound level be if instead of 1 dog, 5 dogs start barking at the same time each delivering 1 mW of power

A. 68 dB, 75 dB

B. 58 dB, 68 dB

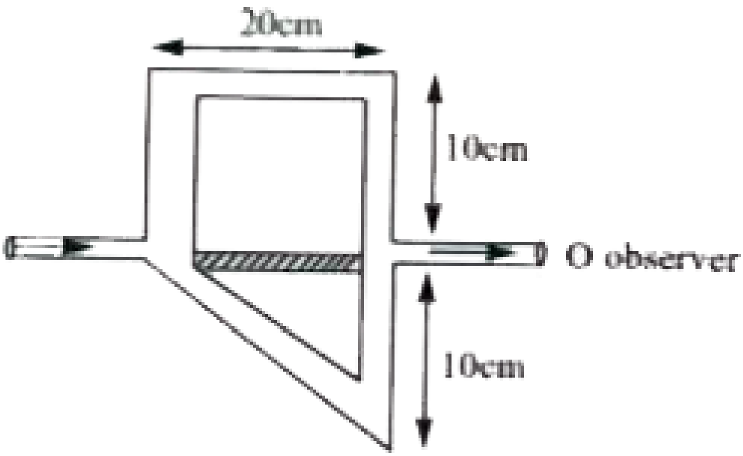
C. 48 dB, 58 dB

D. 38 dB, 28 dB

Answer: A

Watch Video Solution

6. Find out frequency at which maximum intensity detected by observer O. If velocity of sound $= 340 m/s^{-1}$ and frequency range of source 2000 Hz to 5000 Hz



A. 3350 Hz

B. 4450 Hz

C. 2900 Hz

D. None of these

Answer: B

Watch Video Solution

LECTURE SHEET (EXERCISE -IV) (SPEED OF SOUND, INTENSITY OF SOUND, INTERFERENCE OF SOUND WAVES) (LEVEL-II ADVANCED) (MORE THAN ONE CORRECT ANSWER TYPE QUESTIONS)

1. As a wave propagates

A. the wave intensity remains constant for a plane wave

B. the wave intensity decrease as the inverse of the distance from the source for a spherical wave

C. the wave intensity decrease as the inverse square of the distance from the source for spherical wave.

D. total intensity of the spherical wave over the spherical surfac remains constant at all times, while source is at the centre of spherical surface

Answer: A::C::D

Watch Video Solution

LECTURE SHEET (EXERCISE -IV) (SPEED OF SOUND, INTENSITY OF SOUND, INTERFERENCE OF SOUND WAVES) (LEVEL-II ADVANCED) (LINKED COMPREHENSION TYPE QUESTIONS) (PASSAGE -1)

1. A plane longitudinal wave of angular frequency ω=1000 rad/s is travelling along positive x direction in a homogeneous gaseous medium of density $d = 1kgm^{-3}$. Intensity of wave is $I = 10^{-10}W.m^{-2}$ and maximum pressure change is $(\Delta P)_m = 2 \times 10^{-4}Nm^{-2}$. Assuming at x = 0, initial phase of medium particles to be zero

Amplitude of the travelling wave is

(a) $10^{-6}m$

(b) $10^{-7}m$

(c) $10^{-9}m$

(d) $2 \times 10^{-8}m$

A. 10^{-6} m

B. 10^{-7}m

C. $10^9 m$

D. 2×10^{-8} m

Answer: C

Watch Video Solution

2. A plane longitudinal wave of angular frequency ω=1000 rad Is is travelling along positive x direction in a homogeneous gaseous medium of density $d = 1kgm^{-3}$. Intensity of wave is $I = 10^{-10} W. m^{-2}$ and maximum pressure change is $(\Delta P)_m = 2 \times 10^{-4} Nm^{-2}$. Assuming at x = 0, initial phase of medium particles to be zero

Velocity of the wave is

A. $500 ms^{-1}$

B. $100 ms^{-1}$

C. $300 ms^{-1}$

D. $200ms^{-1}$

Answer: D

Watch Video Solution

3. A plane longitudinal wave of angular frequency ω=1000 rad Is is travelling along positive x direction in a homogeneous gaseous medium of density $d = 1kgm^{-3}$. Intensity of wave is $I = 10^{-10}W.m^{-2}$ and maximum pressure change is $(\Delta P)_m = 2 \times 10^{-4}Nm^{-2}$. Assuming at x = 0, initial phase of medium particles to be zero

Velocity of the wave is

A. $y = 10^{-9}\sin(1000t - 5x)m$

B. $y = 10^{-7}\sin(200t - x)m$

C. $y = 10^{-6}\sin(5000t - 500x)$

D. $y = 2 \times 10^{-8}\sin(600t - 2x)$

Answer: A

Watch Video Solution

LECTURE SHEET (EXERCISE -IV) (SPEED OF SOUND, INTENSITY OF SOUND, INTERFERENCE OF SOUND WAVES) (LEVEL-II ADVANCED) (MATRIX MATCHING TYPE QUESTIONS)

1. Match the following:

Column - I	Column - II
A) Reflection in rigid surfaces	p) $f > 20{,}000$ Hz
B) Ultra sonic waves	q) phase change of π radians
C) Reflection at free boundary	r) directon of propagation changes
D) Echo	s) no phase change

Watch Video Solution

LECTURE SHEET (EXERCISE -V) (ORGAN PIPES, BEATS) (LEVEL-I MAIN) (STRAIGHT OBJECTIVE TYPE QUESTIONS)

1. A cylindrical tube, open at both ends, has a fundamental frequency f_0 in air. The tube is dipped vertically into water such that half of its length is inside water. The fundamental frequency of the air column now is

A. $3f_0/4$

B. f_0

C. $f_0/2$

D. $2f_0$

Answer: B

Watch Video Solution

2. An open organ pipe and closed pipe have same length. The ratio of frequencies of their nth over tone 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

3. Fundamental frequency of pipe is 100 Hz and other two frequencies are 300 Hz and 500 Hz then

A. Pipe is open at both the ends

B. pipe is closed at both the ends

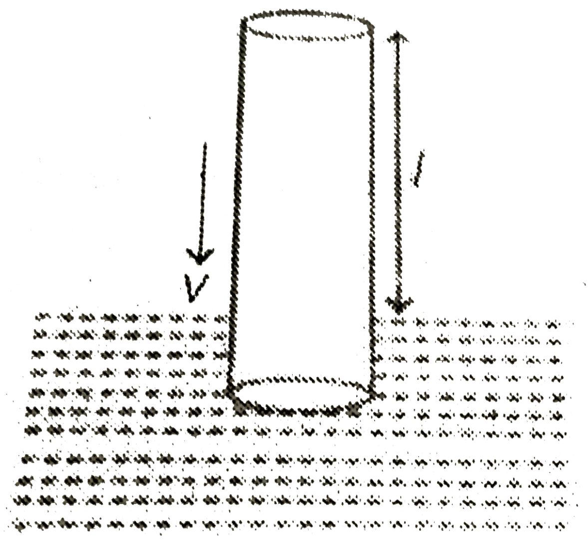
C. One end open and another end is closed

D. None of the above

Answer: C

Watch Video Solution

4. 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. $cv/2l^2$

B. $cv/4l^2$

C. $c/2v^2l^2$

D. $c/4v^2l^2$

Answer: B

Watch Video Solution

5. The frequency of a tuning fork A is 5% greater than that of a standard fork K. The frequency of another fork B is 3% less than that of K. When A and B are vibrated simulataneously 4 beats per second are heard. Find the frequencies of A and B.

A. 52.5 Hz, 48.5 Hz

B. 63.5 Hz, 79.5 Hz

C. 10.5 Hz, 101 Hz

D. 124 Hz, 120 Hz

Answer: A

Watch Video Solution

6. Tuning fork A of frequency 258 Hz gives 8 beats with a tuning fork B. When the tuning fork A is filed and again A and B are sounded the number of beats heard decreases. The frequency of B is

A. 250 Hz

B. 266 Hz

C. 258 Hz

D. 242 Hz

Answer: B

Watch Video Solution

7. Wavelengths of two notes in air are 80/175 m and 80/173 m. Each note produces 4 beats/s. with a third note of a fixed frequency. The speed of sound in air is

A. 400 m/s

B. 300 m/s

C. 280 m/s

D. 320 m/s

Answer: D

Watch Video Solution

8. Two identical sonometer wires have a fundamental frequency of 400 vibrations per second when kept under the same tension. What fractional increase in the tension of one wire would cause an occurance of 8 beats per second when both wires vibrate together

A. 0.02

B. 0.03

C. 0.01

D. 0.04

Answer: D

Watch Video Solution

LECTURE SHEET (EXERCISE -V) (ORGAN PIPES, BEATS) (LEVEL-II) ADVANCED (STRAIGHT OBJECTIVE TYPE QUESTIONS)

1. An open organ pipe of length l vibrates in its fundamental mode. The pressure variation is maximum

A. at the two ends

B. at a distance L/4 from either end inside the tube

C. at the mid-point of the tube

D. none of these

Answer: B

Watch Video Solution

2. A tuning fork of frequency $340Hz$ is excited and held above a cylindrical tube of length $120cm$. It is slowly filled with water. The minimum height of water column required for resonance to be first heard(Velocity of sound $= 340ms^{-1}$) is.

A. 95 cm

B. 75 cm

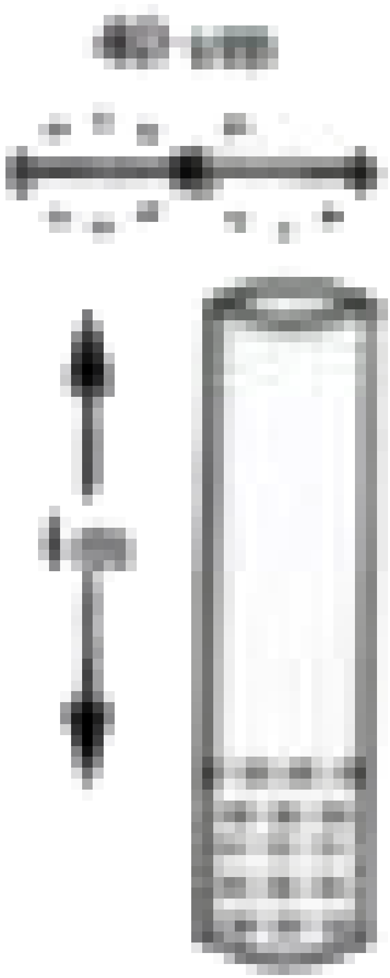
C. 45 cm

D. 25 cm

Answer: C

Watch Video Solution

3. A wire of length 40 cm which has a mass of 4 gms oscillates in its second harmonic and sets the air column in the tube to vibrations in its fundamental mode as shown in figure. Assuming speed of sound in air as 340 m/s, find the tension in the wire.



A. 11.56 N

B. 12.54 N

C. 13. 46 N

D. 11. 36 N

Answer: A

Watch Video Solution

4. A pipe's lower end is immersed in water such that the length of air column from the top open end has a certain length 25 cm. The speed of sound in air is 350 m/s. The air column is found to resonate with a tuning fork of frequency 1750 Hz. By what minimum distance should the pipe be raised in order to make the air column resonate again with the same tuning fork?

(a) 7cm

(b) 5cm

(c) 35cm

(d) 10cm

A. 7 cm

B. 5 cm

C. 35 cm

D. 10 cm

Answer: D

Watch Video Solution

5. Two sounding bodies are producing progressive waves given by $y_1 = 4\sin(400\pi t)$and $y_2 = 3\sin(404\pi t)$, where t is in second which superpose near the ears of a person. The person will hear

A. 2 beats per second withintensity ratio $\frac{4}{3}$ between maxima and minima.

B. 2 beats per second with intensity ratio 49 between maxima and minima

C. 4 beats per second with intensity ratio 7 between maxima and minima

D. 4 beats per second with intensity ratio $\frac{4}{3}$ between maxima and minima

Answer: B

Watch Video Solution

6. In an organ pipe whose one end is at x =0, the pressureis expressed by $P = P_0 \cos\frac{3\pi x}{2}\sin 300\pi t$ where x is in meter and t in sec. The organ pipe can be :-

A. closed at one end, open at another with length = 0.5m

B. open at both ends, length = lm

C. closed at both ends, length = 2m

D. closed at one end, open at another with length = $\frac{2}{3}$ m

Answer: C

Watch Video Solution

7. A tuning fork and an organ pipe at temperature $88^\circ C$ produce 5 beats per second. When the temperature of the air column is decreased to $51^\circ C$ the two produce 1 beat per sec. What is the frequency of the tuning fork?

A. f.=81Hz

B. f.=71Hz

C. f.=110Hz

D. f.=55Hz

Answer: B

Watch Video Solution

Watch Video Solution

8. A string under a tension of 129.6 N produces 10 beats per sec when it is vibrated along with a tuning fork. When the tension in the string is increased to 160 N, it sounds in unison with the same tuning fork, Calculate the fundamental frequency of the tuning fork.

A. 88 Hz

B. 100 Hz

C. 110 Hz

D. 121 Hz

Answer: B

Watch Video Solution

LECTURE SHEET (EXERCISE -V) (ORGAN PIPES, BEATS) (LEVEL-II) ADVANCED (MORE THAN ONE CORRECT ANSWER TYPE QUESTIONS)

1. Along the straight line joining two consecutive displacement nodes in a pure stationary sound wave at different points

A. the S.H.M.s will be in different phases

B. Velocities are in phase

C. the accelerations are inphase

D. frequencies are equal

Answer: B::C::D

Watch Video Solution

2. Two choherent waves represented by $y_1 = A\sin\left(\frac{2\pi x_1}{\lambda} - wt + \frac{\pi}{3}\right)$ and $y_2 = A\sin\left(\frac{2\pi x_2}{\lambda} - wt + \frac{\pi}{6}\right)$ are superposed. The two waves will produce

A. Constructive interference at $(x_1 - x_2) = 2\lambda$

B. Constructive interference at $(x_1 - x_2) = \frac{23\lambda}{24}$

C. destructive interference at $(x_1 - x_2) = 1.5\lambda$

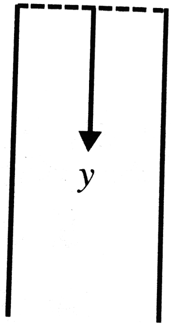
D. destructive interference at $(x_1 - x_2) = \frac{11\lambda}{24}$

Answer: B::D

Watch Video Solution

LECTURE SHEET (EXERCISE -V) (ORGAN PIPES, BEATS) (LEVEL-II) ADVANCED (LINKED COMPREHENSION TYPE QUESTIONS)

1. In an organ pipe (may be closed or open) of $99cm$ length standing wave is set up , whose equation is given by longitudinal displacement.



$\xi = (0.1mm)\frac{\cos(2\pi)}{0.8}(y + 1cm)\cos(400)t$where y is measured from the top of the tube in $metres$ and $tinseconds$. Here $1cm$ is the end correction.

The air column is vibrating in

A. First overtone

B. Fifth harmonic

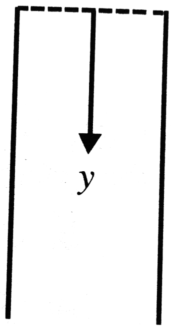
C. Third harmonic

D. Fundamental mode

Answer: B

Watch Video Solution

2. In an organ pipe (may be closed or open) of $99cm$ length standing wave is set up , whose equation is given by longitudinal displacement.



$\xi = (0.1mm)\frac{\cos(2\pi)}{0.8}(y + 1cm)\cos(400)t$where y is measured from the top of the tube in *metres* and t*inseconds* . Here $1cm$ is the end correction.

The air column is vibrating in

A. $P_{ex} = \left(125\pi N/m^2\right)\frac{\sin(2\pi)}{0.8}(y + 1cm)\cos 2\pi(400t)$

B. $P_{ex} = \left(125\pi N/m^2\right)\frac{\cos(2\pi)}{0.8}(y + 1cm)\sin 2\pi(400t)$

C. $P_{ex} = \left(225\pi N/m^2\right)\frac{\sin(2\pi)}{0.8}(y + 1cm)\cos 2\pi(200t)$

D. $P_{ex} = \left(225\pi N/m^2\right)\frac{\cos(2\pi)}{0.8}(y + 1cm)\sin 2\pi(200t)$

Answer: A

Watch Video Solution

LECTURE SHEET (EXERCISE -V) (ORGAN PIPES, BEATS) (LEVEL-II) ADVANCED (INTEGER TYPE QUESTIONS)

1. A closed organ pipe and an open organ pipe of same length produce 4 beats when they are set into vibrations simultaneously. If the length of each of them were twice their initial lengths, the number of beats produced will be

Watch Video Solution

2. A glass tube 1.5 m long and open at both ends is immersed vertically in a water tank completely. A tuning fork or 660 Hz. Is vibrated and kept at the upper end of the tube and the tube is gradually raised out of water . The total number of resonances heard before the tube comes out of water taking velocity of sound air 330 m//sec is

Watch Video Solution

3. A pop-gun consists of a cylindrical barrel 3cm2 in cross-section closed at one end by a cork and having a well fitting piston at the other. If the piston is pushed slowly in, the cord is finally ejected, giving a pop, the frequency of which is found to be 512Hz. Assuming that the initial distance between the cork and the piston was 25cm and there is no leakage of air, If the force required to eject the cork is 0.75 x xkg-wt. Find the value of x. Atmospheric pressure = $1kgwt/cm^2$, v = 340 m/s.

Watch Video Solution

LECTURE SHEET (EXERCISE -VI) (DOPPLER EFFECT) (LEVEL -I MAIN) (STRAIGHT OBJECTIVE TYPE QUESTIONS)

1. A whistle producing sound waves of frequencies 9500 Hz and is approaching a stationary person with speed vms^{-1}. The velocity of sound in air is 300 ms^{-1} . If the person can hear frequencies upto a maximum of 10,000 Hz. The maximum value of 0 upto which he can hear the whistle is

A. $30ms^{-1}$

B. $15\sqrt{2}ms^{-1}$

C. $15\sqrt{2}ms^{-1}$

D. $15ms^{-1}$

Answer: D

Watch Video Solution

2. An observer moves towards a stationary source of sound with a velocity one-fifth of velocity of sound. The percentage increase in apparent frequency i

A. 5%

B. 20%

C. zero

D. 0.005

Answer: B

Watch Video Solution

3. Two trains are moving towards each other at speeds of 144 km/hr and 54 km/hr relative to the ground. The first train sounds a whistle of frequency 600 Hz. Find the frequency of the whistle as heard by a passenger in the second train before the trains meet. (v=340m/s)

A. 610 Hz

B. 510 Hz

C. 710 Hz

D. 170 Hz

Answer: C

Watch Video Solution

4. The apparent wavelength of light from a star moving away from earth is observed to be 0.01% more than its real wavelength. The velocity of star is

A. 120 kms^{-1}

B. $90kms^{-1}$

C. $60 kms^{-1}$

D. $30 kms^{-1}$

Answer: D

Watch Video Solution

5. A rocket is receding away from earth with velocity 0.2C. The rocket emits signal of frequency $4 \times 10^7 Hz$. The apparent frequency of the signal produced by the rocket observed by the observer on earth will be

A. 3×10^6 Hz

B. 4×10^6 Hz

C. 2.4×10^7 Hz

D. 3.33×10^7 Hz

Answer: D

Watch Video Solution

6. When a train is approaching the stationary observer, the apparent frequency of the whistle observed as 100 Hz, while when it has passed away from the observer with same speed, it is 50 Hz. Calculate the frequency of the whistle when the observer moves with the train V = 330 m/s)

A. 33.3 Hz

B. 50 Hz

C. 66.6 Hz

D. 75 Hz

Answer: C

Watch Video Solution

7. A person is listening to two trains one approaching him while the other moving away from him. The speed of both the trains is 5 m/s. If both trains give off whistle of their nature frequency of 280 Hz then the observer will hear ... no of beats/s. (Velocity of sound = 350 m/s)

A. 6

B. 7

C. 5

D. 8

Answer: D

Watch Video Solution

8. Two different sound sources s_1 and so have frequencies ratio 1:2. Source s_2 is approaching towards an observer s_1 and s_2 is receding from the same observer. Speeds of both s_1 and s_2 are the same and equal to v. speed of sound in air in 300 m / s. If no beats are heard by the observer the value of V is

A. 125 m/s

B. 100 m/s

C. 75 m/s

D. 50 m/s

Answer: B

Watch Video Solution

9. A siren placed at a railway platfrom is emitted sound of frequency $5kH_Z$, A passenger sitting in retun journey in a different train B he records a frequency of $6.0kH_Z$ while approaching the same siren. The ratio of the velocity of train B to that of train A is

A. $\frac{242}{252}$

B. 2

C. $5/6$

D. $11/6$

Answer: B

Watch Video Solution

10. A spectral line is obtained from a gas discharge tube at 5000Å. If the rms velocity of gas molecules is $10^5 ms^{-1}$, then the width of spectral line will be

A. $1.66A^0$

B. $4.8A^0$

C. $7.2A^0$

D. $9.1A^0$

Answer: A

Watch Video Solution

11. An observer measures speed of light to be C, when he is stationary with respect to the source. If the observer moves with velocity V towards the source then the velocity of light observed will be

A. C-V

B. C +V

C. $\sqrt{1 - \frac{V^2}{C^2}}$

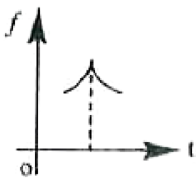
D. C

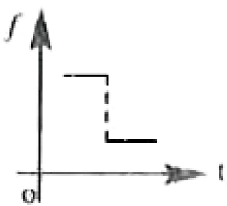
Answer: D

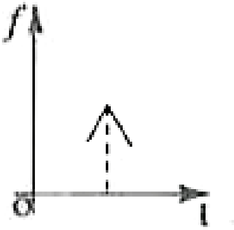
Watch Video Solution

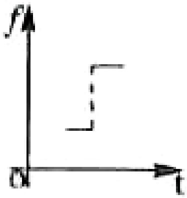
LECTURE SHEET (EXERCISE -VI) (DOPPLER EFFECT) (LEVEL -II ADVANCED) (STRAIGHT OBJECTIVE TYPE QUESTIONS)

1. A source of sound emitting a note of constant frequency is moving towards a stationary listener and then recedes from the listener with constant velocity maintained throughout the motion. The frequency heard by the listener (f). when plotted against time (t) will give the following curve(s).

A. 

B. 

C. 

D. 

Answer: B

Watch Video Solution

2. 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. 0.143

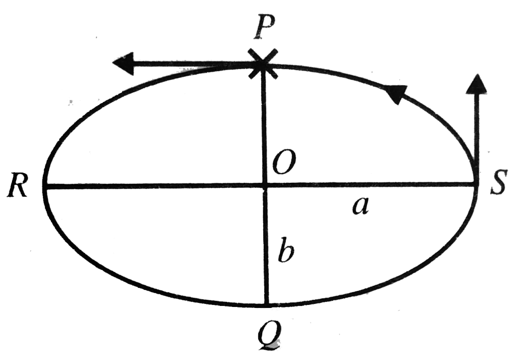
B. 0.2

C. 0.1

D. 0.0833

Answer: D

Watch Video Solution



3.

A train is moving in an elliptical orbit in anticlockwise sense with a speed of $110\frac{m}{s}$. Guard is also moving in the given direction with same speed as that of train. The ratio of the length of major and minor axes is $\frac{4}{3}$. Driver blows a whistle of 1900 Hz at P, which is received by guard at S. The frequency received by guard is (velocity of sound $v = 330\frac{m}{s}$)

A. 1900 Hz

B. 1800 Hz

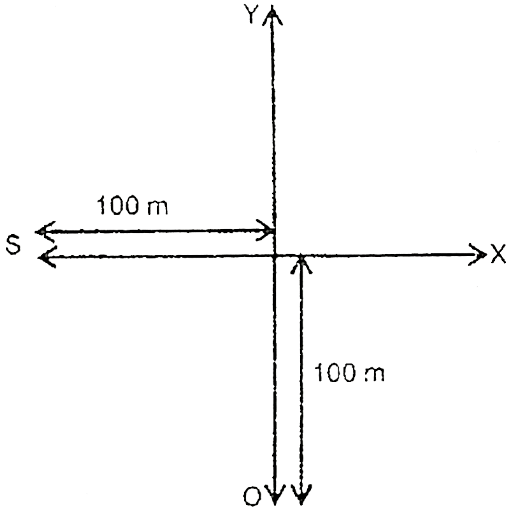
C. 2000 Hz

D. 1500 Hz

Answer: B

Watch Video Solution

4. At $t = 0$, a source of sonic oscillations S and on observer O start moving along x and y axes with $5m/s$ and $10m/s$. The figure shows their positions at $t = 0$. If frequency of source is $1000Hz$. Find the frequency of singals received after 5 second. $V_{sound} = 330 m/\sec.$



A. 1020 Hz

B. 1010 Hz

C. 1030 Hz

D. 1100 Hz

Answer: C

Watch Video Solution

5. A source emitting a sound of frequency f is placed at a large distance from an observer. The source starts moving towards the observer with a uniform acceleration a. Find the frequency heard by the observer corresponding to the wave emitted just after the source starts. The speed of sound in the medium is v.

A. $\frac{Vv^2}{2Vv - a}$

B. $\frac{2V^2v}{2Vv - a}$

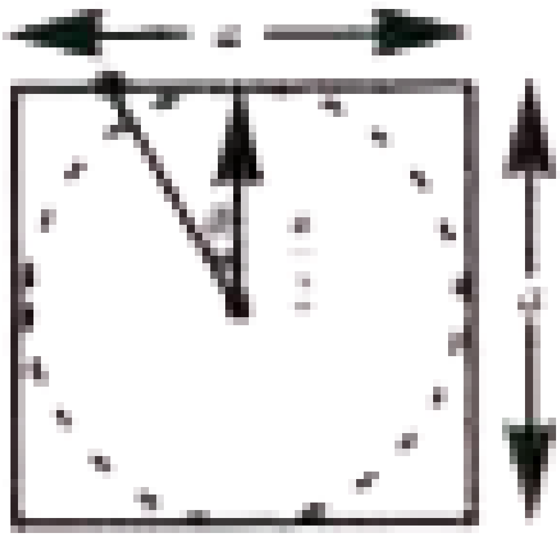
C. $\frac{2Vv}{Vv - a}$

D. $\frac{2Vv^2}{2Vv - a}$

Answer: B

Watch Video Solution

6. A square ground of side $a = \frac{10}{\sqrt{2}}$ m has a circular running track of radius a/2 with its centre coinciding the centre of the ground. A man is running on the track with an angular velocity ω = 22 rad /s while a car is moving on a road adjacent to ground as shown in the figure. The car moves in such away that the car, the man and the centre of the ground always lie on the same straight line. If a source of sound of frequency v = 300 Hz is being placed at the centre of the ground find the minimum frequency received by the man in the car. Assume velocity of sound in air is v = 330 m/s.



A. 200 Hz

B. 210 Hz

C. 190 Hz

D. None

Answer: A

Watch Video Solution

7. Consider two sound sources S_1 and S_2 having same frequency 100Hz and the observer O located between them as shown in the fig. All the three are moving with same velocity in same direction. The beat frequency of the observer is

A. 50 Hz

B. 5 Hz

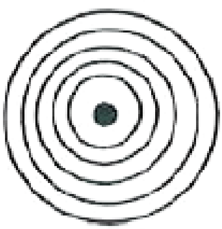
C. zero

D. 2.5 Hz

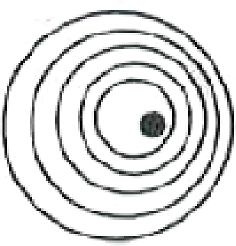
Answer: C

Watch Video Solution

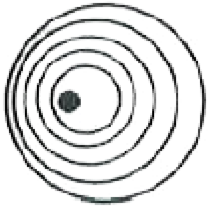
8. If the source is moving towards right, wavefront of sound waves get modifies to



A.



B.

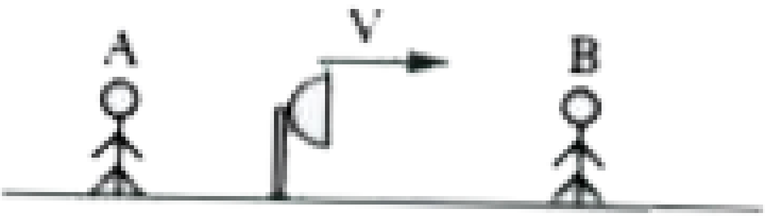
C. 

D. None of these

Answer: B

Watch Video Solution

9. When the source moves with a velocity v, the ratio of wavelengths received by A and B will be (c = speed of Sound):



A. $\frac{c+v}{c+v}$

B. $\frac{c-v}{c+v}$

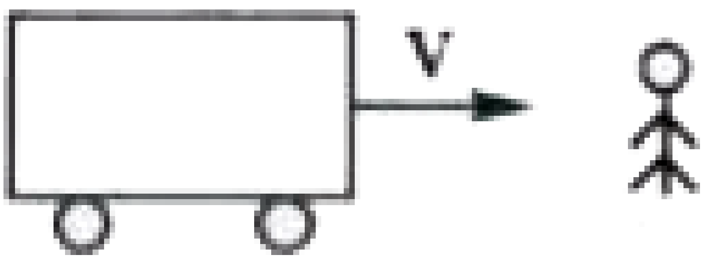
C. $\frac{c}{v}$

D. $\frac{c^2 + v^2}{c^2 - v^2}$

Answer: A

Watch Video Solution

10. A jeep passes by you with a speed v. If the speed of sound is c, the ratio of frequencies just before and after jeep passes you is 5/6. Then, the speed v= (Assume c= 330 m/s)



A. 20 m/s

B. 30 m/s

C. 25 m/s

D. none of these

Answer: B

Watch Video Solution

11. A whistle of frequency f_0 = 1300 Hz is dropped from a height H = 505 m above the ground. At the same time, a detector is projected upwards with velocity $v = 50ms^{-1}$ along the same line. If the velocity of sound is $c = 300ms^{-1}$ find the frequency detected by the detector after t = 5s.

A. 500 Hz

B. 700 Hz

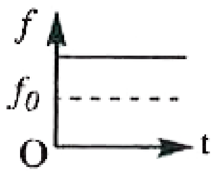
C. 1500 Hz

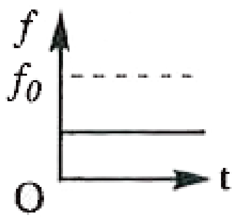
D. 2500 Hz

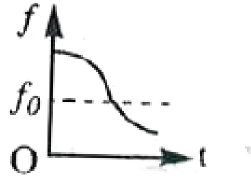
Answer: C

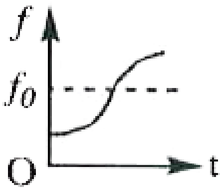
Watch Video Solution

12. 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

Watch Video Solution

LECTURE SHEET (EXERCISE -VI) (DOPPLER EFFECT) (LEVEL -II ADVANCED) (MORE THAN ONE CORRECT ANSWER TYPE QUESTIONS)

1. A sound wave of frequency f travels horizontally to the right . It is teflected from a larger vertical plane surface moving to left with a speed v. the speed of sound in medium is c

(a) The number of waves striking the surface per second is $\frac{f(c+v)}{c}$

(b) The wavelength of reflected wave is $\frac{c(c - \upsilon)}{f(c + \upsilon)}$

(c) The frequency of the reflected wave is $\frac{f((c + \upsilon))}{(c + \upsilon)}$

(d) The number of beats heard by a stationary listener to the left of the reflecting surface is $\frac{\upsilon f}{c - \upsilon}$

A. The frequency of the reflected wave is $\frac{f(c + v)}{c - v}$

B. The wave length of the reflected wave is $\frac{c(c - v)}{f(c + v)}$

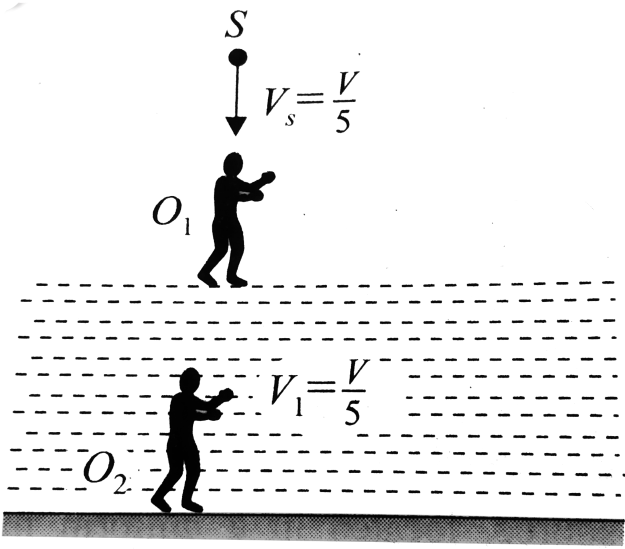
C. The number of waves striking the surface per second is $\frac{f(c + v)}{c}$

D. The number of beats heard by a stationary listener to the left of the reflecting surface is $\frac{fv}{c - v}$

Answer: A::B::C

Watch Video Solution

2.



In the figure shown, an observer O_1 floats (static) on water surface with ears in air while another observer O_2 is moving upwards with constant velocity $V_1 = \frac{V}{5}$ in water. The source moves down with constant velocity $V_S = \frac{V}{5}$ and emits sound of freqeuncy f. The velocity of sound in air is V and that in water is $4V$. For the situation shown in figure.

A. The wave length of the sound received by O_1 is 4v/5f

B. The wave length of the sound received by O_1 is v/f

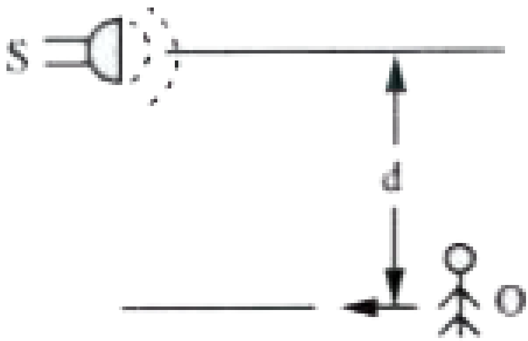
C. The frequency of the sound received by O_2 is 2 if/ 16

D. The wavelength of the sound received by is $\frac{4v}{7f}$

Answer: A::C::D

Watch Video Solution

3. When a source and observer move in a parallel track as shown in the figure, the ratio of appeares and actual frequency can be



A. > 1

B. $= 1$

C. < 1

D. none of these

Answer: A::B

Watch Video Solution

4. A railroad train is travelling at 30.0 m/s in still air. The frequency of the note emitted by the train whistle is 262 Hz. Speed of sound in air is 340 m/s.

A. Frequency heard by a passenger on another train moving in the opposite direction to the first at 18.0 m/s and approaching the first is 302 Hz

B. Frequency heard by a passenger on another train moving in the opposite direction to the first at 18.0 m/s and receding from the first is 228 Hz

C. Frequency heard by a passenger on another train moving in the same direction of the first at 18.0 m/s and approaching the first is 272 Hz

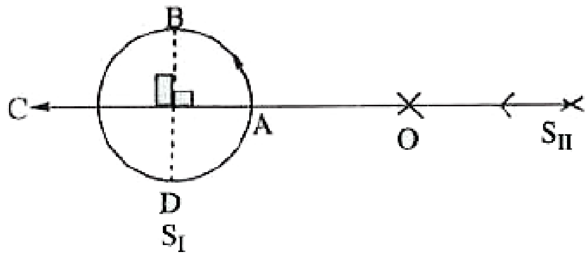
D. Frequency heard by a passenger on another train moving in the same direction of the first at 18.0 m/s and receding the first is 253 Hz

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

Watch Video Solution

LECTURE SHEET (EXERCISE -VI) (DOPPLER EFFECT) (LEVEL -II ADVANCED) (LINKED COMPREHENSION TYPE QUESTIONS) (PASSAGE -I)

1. As shown in the figure two sources producing sound Sr and Sn (velocity of sound 360 m/sec) each producing sound of frequency 200 Hz. S_1 is rotating anti clock wise where as S_n is approaching observer O each with a speed 10 m/sec. (neglect radius of circular path of S_1), then calculate



Range of number of beats received by observer O at rest is (nearly)

A. 0 to 11.2

B. 0 to5.7

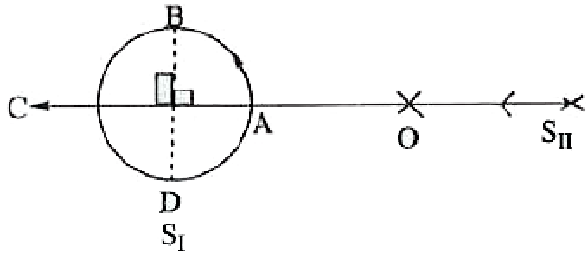
C. 1 to 4

D. 0 to 7.5

Answer: A

Watch Video Solution

2. As shown in the figure two sources producing sound Sr and Sn (velocity of sound 360 m/sec) each producing sound of frequency 200 Hz. S_1 is rotating anti clock wise where as S_n is approaching observer O each with a speed 10 m/sec. (neglect radius of circular path of S_1), then calculate



If O is approaching S_1 with a speed 10 m/sec. Number of beats received by .O. per second when S_1 is at A, (nearly)

A. 4 beats/sec

B. 5.5 beats/sec

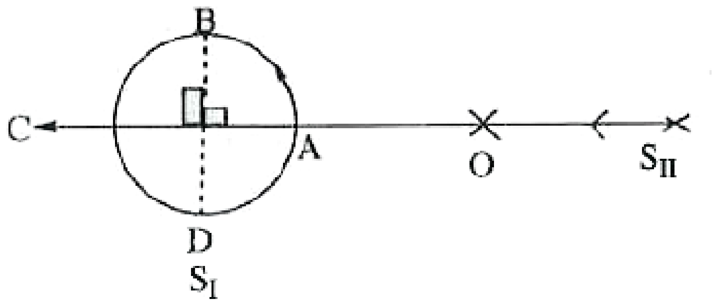
C. 3 beats/sec

D. beats cannot be distinguished

Answer: B

Watch Video Solution

3. As shown in the figure two sources producing sound Sr and Sn (velocity of sound 360 m/sec) each producing sound of frequency 200 Hz. S_1 is rotating anti clock wise where as S_n is approaching observer O each with a speed 10 m/sec. (neglect radius of circular path of S_1), then calculate



If wind is blowing from right to left with a speed 10 m/sec and observer is at rest find the number of beats received by observer when S_1 is at A. (nearly)

A. 5.5

B. 5

C. 4

D. 11

Answer: A

Watch Video Solution

LECTURE SHEET (EXERCISE -VI) (DOPPLER EFFECT) (LEVEL -II ADVANCED) (LINKED COMPREHENSION TYPE QUESTIONS) (PASSAGE -II)

1. There is a detective submarine installed inside sea water post 26/11 incident to detect terrorists. It is moving with constant speed V_θ along a straight line and it sends a wave which travels with speed V_w = 1100m/sec in water. Initially waves are getting reflected from a fixed Island and the frequency detected by the submarine is found to be

20% more than the original frequency. When a terrorist ship moving towards the submarine with constant speed V_s comes in between the submarine and the island. Frequency of waves reflected from the ship is 80% more than the original frequency.

Bulk modulus of sea water is

A. 50 m/sec

B. 100 m/sec

C. 10 m/s

D. 25 m/s

Answer: B

Watch Video Solution

2. There is a detective submarine installed inside sea water post 26/11 incident to detect terrorists. It is moving with constant speed V_θ along a straight line and it sends a wave which travels with speed

V_w = 1100m/sec in water. Initially waves are getting reflected from a fixed Island and the frequency detected by the submarine is found to be 20% more than the original frequency. When a terrorist ship moving towards the submarine with constant speed V_s comes in between the submarine and the island. Frequency of waves reflected from the ship is 80% more than the original frequency.

Bulk modulus of sea water is

A. 220 m/sec

B. 110 m/s

C. 200 m/s

D. None

Answer: A

Watch Video Solution

3. There is a detective submarine installed inside sea water post 26/11 incident to detect terrorists. It is moving with constant speed V_θ along a straight line and it sends a wave which travels with speed V_w = 1100m/sec in water. Initially waves are getting reflected from a fixed Island and the frequency detected by the submarine is found to be 20% more than the original frequency. When a terrorist ship moving towards the submarine with constant speed V_s comes in between the submarine and the island. Frequency of waves reflected from the ship is 80% more than the original frequency.

Bulk modulus of sea water is

A. $10^9 N/m^2$

B. $1.21 \times 10^9 N/m^2$

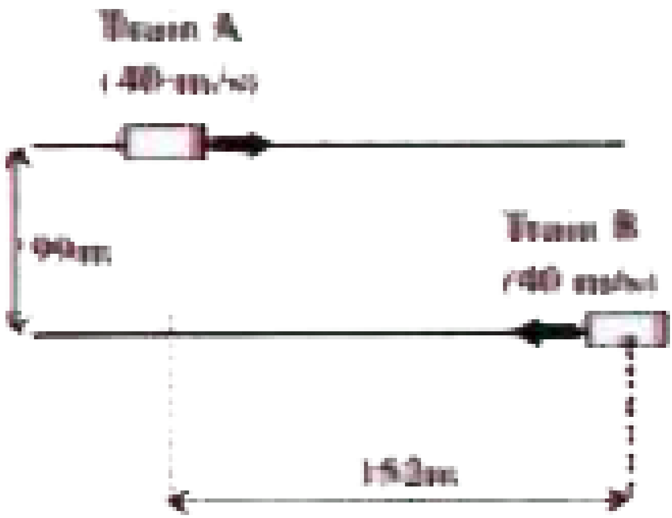
C. $1.5 \times 10^2 N/m^2$

D. None

Answer: B

LECTURE SHEET (EXERCISE -VI) (DOPPLER EFFECT) (LEVEL -II ADVANCED) (MATRIX MATCHING TYPE QUESTIONS)

1. Train A and B are approaching towards each other on a parallel track 99 m apart at t = 0 their position are shown. Train A whistles a short pulse of frequency of 596 Hz. Velocity of sound is 330 m/s.



LECTURE SHEET (EXERCISE -VI) (DOPPLER EFFECT) (LEVEL -II ADVANCED) (INTEGER TYPE QUESTIONS)

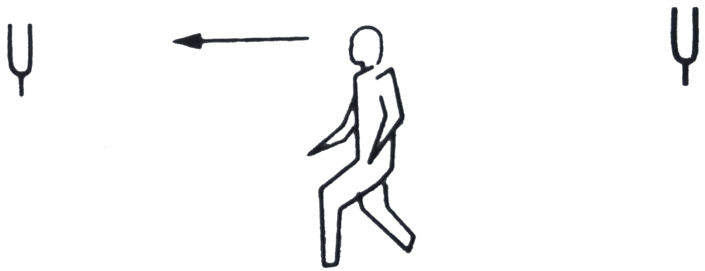
1. two trains move towards each other sith the same speed. The speed of sound is 340 m/s. If the height of the tone of the whistle of one of them heard on the other changes 9/8 times, then the speed of each train should be

Watch Video Solution

2. An observer is moving with a constant speed of 20m/s on a circular track of radius 50m. A source kept at centre of track emits a sound of frequency 200 Hz. Then the frequency received by the observer is $x \times 10^2$ Hz, what is value of x. (V= 340m/s)

Watch Video Solution

3. Two identical tuning forks vibrating at the same frequency 256 Hz are kept fixed at some distance apart. A listener runs between the forks at a speed of $3.0ms^{-1}$ so that he approaches one tuning-fork and recedes from the other. find the beat frequency observed by the listener. Speed of sound in air $= 332ms^{-1}$.



Watch Video Solution

4. A car travelling at a speed of 8 m/s towards a large wall horns a sound of frequency 130 Hz if the person stands behind the car such that the car receding from him approaches the wall the no. of beats heard by him per second is (velocity of speed in air 340 m/s)

Watch Video Solution

PRACTICE SHEET (EXERCISE -I) (GENERAL WAVE EQUATION) (LEVEL-I MAIN) (STRAIGHT OBJECTIVE TYPE QUESTIONS)

1. The time lag between two particles vibrating in a progressive wave seperated by a distance 20m is 0.02s. The wave velocity If the frequency of the wave is 500Hz, is

A. $1000 ms^{-1}$

B. $500 ms^{-1}$

C. $2000 ms^{-1}$

D. $250 ms^{-1}$

Answer: A

Watch Video Solution

2. The path difference between the two waves :

$$y_1 = a_1 \sin\left(\omega t - \frac{2\pi x}{\lambda}\right) \text{ and}$$

$$y_2 = a_2 \cos\left(\omega t - \frac{2\pi x}{\lambda} + \phi\right) \text{ is}$$

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

B. $\frac{\lambda}{2\pi}\left(\phi + \frac{\pi}{2}\right)$

C. $\frac{2\pi}{\lambda}\left(\phi - \frac{\pi}{2}\right)$

D. $\frac{2\pi}{\lambda}\phi$

Answer: B

Watch Video Solution

3. The maximum particle velocity is 3 times the wave velocity of a progressive wave. If the amplitude of the particle is "a". The phase difference between the two particles seperated by a distance of 'x' is

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

B. $\frac{3x}{a}$

C. $\frac{3a}{x}$

D. $\frac{3\pi x}{a}$

Answer: B

Watch Video Solution

4. Which of the following equation reprsents a wave ?

A. $(x - vt)^2$

B. $(x + vt)^2$

C. $e^{-x(x-vt)^2}$

D. $\frac{1}{x + vt}$

Answer: C

Watch Video Solution

5. Which one of the following represent travelling wave

A. $y = A\sqrt{x - vt}$

B. $y = A\cos(ax + bt)$

C. $y = A\log(x - vt)$

D. $y = f\left(x^2 - vt^2\right)$

Answer: C

Watch Video Solution

PRACTICE SHEET (EXERCISE -I) (GENERAL WAVE EQUATION) (LEVEL-II ADVANCED) (STRAIGHT OBJECTIVE TYPE QUESTIONS)

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

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

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-axis with speed $2m/s$?

A. $y = \dfrac{10}{\left(x^2 + 2y\right)^2 + 2}$

B. $y = \dfrac{10}{\left(x^2 + 2t\right)^2 + 2}$

C. $y = \dfrac{10}{(x - 2t)^2 + 2}$

D. $y = \dfrac{10}{(x + 2t)^2 + 2}$

Answer: C

Watch Video Solution

2. The displacement of A particle at x = 0 of a stretched string carrying a wave in the positive X-direction is given by $f(t) = Ae^{-t^2}$. The wave speed is V. Write equation of the wave.

A. $f(x, t) = Ae^{(-t+x)^2}$

B. $f(x, t) = Ae^{-\left(t - \frac{x}{v}\right)^2}$

C. $f(x, t) = Ae^{\left(t + \frac{x}{v}\right)^2}$

D. $f(x, t) = Ae^{\left(-t + \frac{x}{v}\right)^2}$

Answer: B

Watch Video Solution

3. The equation $y = A\cos^2\left(2\pi nt - 2\pi\frac{x}{\lambda}\right)$ represents a wave with

A. amplitude a, frequency n and wavelength λ

B. amplitude a, frequency 2n and wavelength 2λ

C. amplitude a/2, frequency 2n and wavelength λ

D. amplitude a/2, frequncy 2n and wavelength $\lambda/2$

Answer: D

Watch Video Solution

4. A wave propagates on a string in positive x-direction with a speed of 40 cm/s. The shape of string at t = 2 s is $y=10\frac{\cos x}{5}$ where x and y are in centimeter. The wave equation is

A. $y = 10\cos\left(\frac{x}{5} - 8t\right)$

B. $y = 10\sin\left(\frac{x}{5} - 8t\right)$

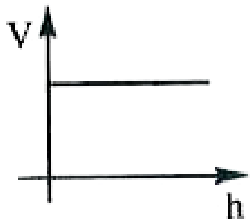
C. $y = 10\cos\left(\frac{x}{5} - 8t + 16\right)$

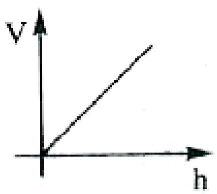
D. $y = 10\sin\left(\frac{x}{5} - 8t + 16\right)$

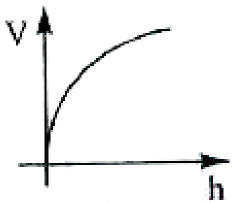
Answer: C

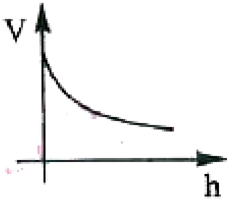
Watch Video Solution

5. 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. 

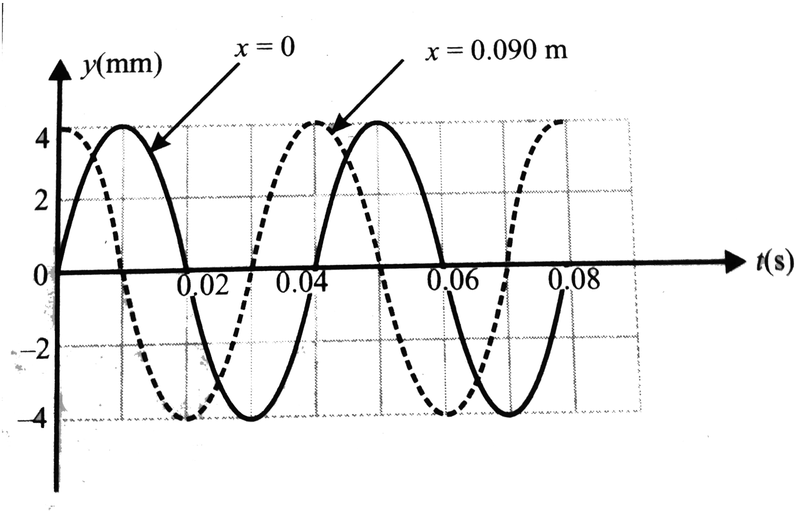
C. 

D. 

Answer: C

Watch Video Solution

6. A sinusoidal wave is propagating along a streched string that lies along the x-axis. The displacement of the string as a function of time is graphed in for particles at x-0 and at x=0.0900 m. (a) what is the amplitude of the wave? (b)what is the period of the wave? (c) you are told that the two points x=0 and x=0.0900 m are within one wavelength of each other. if the wave is moving in the +x-direction, determine the wavelength and the wave speed. (d) if instead the wave is moving in the -x-direction, determine the wavelength and the wave speed. (e) would it be possible to derermine definitely the wavelength in parts (c) and (d) if you were not told that the two points were within one wavelength of each other? why ot why not?



A. 3 m/s

B. 3.8 m/s

C. 9.1 m/s

D. 2.2 m/s

Answer: B

Watch Video Solution

7. A progressive wave has a shape (or waveform) given by the equation, $y = \frac{2}{\left(x^2 - 6x + 14\right)^{3/2}}$, at the instant time t = 1. Express the wave equation in terms of time t,

A. $y = \frac{2}{\left[5 + (x - 3t)^2\right]^{3/2}}$

B. $y = \frac{2}{\left[3 + (x - 3t)^2\right]^{3/2}}$

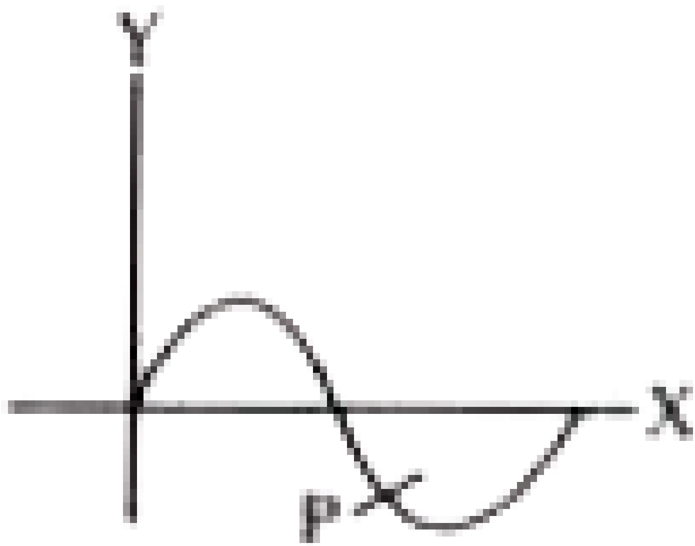
C. $y = \frac{2}{\left[3 + (x - 3t)^2\right]^{1/2}}$

D. $y = \frac{2}{\left[3 + (2x - 3t)^2\right]^{1/2}}$

Answer: A

Watch Video Solution

8. A travelling wave in a string has speed 5 cm/s in -ve x direction its amplitude is 10 mm and wavelength 1 m. At a particular time a point P has displacement $5\sqrt{3}$ mm. Find the velocity vector of point P ?



A. $\frac{\pi}{20}\hat{j} m/s$

B. - $\frac{\pi}{20}\hat{i} cm/s$

C. - $\frac{\pi}{20}\hat{j} cm/s$

D. + $\frac{2\pi}{35}\hat{i} cm/s$

Answer: C

Watch Video Solution

PRACTICE SHEET (EXERCISE -I) (GENERAL WAVE EQUATION) (LEVEL-II ADVANCED) (MORE THAN ONE CORRECT ANSWER TYPE QUESTIONS)

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

A. wave is travelling along negative x- axis.

B. The speed of the wave is 100 cm/s

C. The frequency wave is $50s^{-1}$

D. The maximum speed of a portion of string is = 3.14 cm/s

Answer: A::C::D

Watch Video Solution

2. Which of the following does not represent a travelling wave

A. A(ax-bt)

B. $A\tan[\omega t - kx)$

C. $A\cos^2(vt - x)$

D. $A\cos kx.\ \tan(\omega t)$

Answer: A::B::D

Watch Video Solution

3. The equation of a wave is $y = 4\sin\left\{\frac{\pi}{2}\left(2t + \frac{x}{8}\right)\right\}$ where y , x are in cm and time in seconds. The phase difference between two position of the same particle which are occupied at time interval of 0.4 s is $x\pi \times 10^{-1}$, what is the value of x ?

A. The amplitude, wavelength, velocity and frequency of wave are 4cm, $16cm, 32cm^{-1}$ and 1Hz respectively with wave propagating along + x direction,

B. The amplitude, wavelength, velocity and frequency of wave are 4cm, 32cm, 16cm/s, and 0.5Hz respectively with wave propagating along -x direction

C. Two position occupied by the particle at time interval of 0.4s have a phase difference of 0.4π radian

D. Two position occupied by the particle at separation of 12 cm have a phase difference of 135°

Answer: B::C::D

Watch Video Solution

4. $x(x, t) = \dfrac{0.8}{\left[(4x + 5t)^2 + 5\right]}$, represents a moving pulse where x and y are in metre and t is in second. Find

(i) The direction of wave propagation.

(ii) The wave speed.

(iii) The maximum displacement from the mean position (i.e., the aplitude of the wave).

(iv). Whether the wave pulse is symmetric or not.

A. pulse is moving in positive x-direction

B. in 2 s it will travel a distance of 2.5 m

C. its maximum displacement is 0.16m

D. it is a symmetric pulse

Answer: B::C::D

Watch Video Solution

5. A transverse sinusoidal wave of amplitude a, wavelength λ and frequency f is travelling on a stretched string. The maximum speed of any point on the string is v/10, where v is the speed of propagation of the wave. If $a = 10^{-3} m$ and y = 10m/s, then λ and f are given by

A. $\lambda = 2\pi \times 10^{-2} m$

B. $\lambda = 10^{-3}$ m

C. $f = \frac{10^3}{2\pi} Hz$

D. $f = 10^4 Hz$

Answer: A::C::D

Watch Video Solution

6. A wave is represented by the equation :$y = A\sin(10\pi x + 15\pi t + \pi/3)$ where, x is in metre and t is in second. The expression represents.

A. a wave travelling in the positive x-direction with a velocity 1.5m/s

B. a wave travelling in the negative x-direction with a velocity 1.5m/s

C. a wave travelling in the negative x-direction with a wavelength 0.2m

D. a wave travelling in the positive x-direction with a wavelength 0.2m

Answer: B::C

Watch Video Solution

7. A wave eqution which gives the displacement along Y-direction is given by

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

where x and y are in metres and t is time in seconds. This represents a wave

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

B. of wavelength (π) m

C. of frequency $\left(\frac{30}{\pi}\right)Hz$

D. of amplitude 10^{-4} m

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

Watch Video Solution

PRACTICE SHEET (EXERCISE -I) (GENERAL WAVE EQUATION) (LEVEL-II ADVANCED) (LINKED COMPREHENSION TYPE QUESTIONS) (PASSAGE -I)

1. The figure represents the instantaneous picture of a transverse harmonic wave traveling along the negative x-axis. Choose the correct alternative(s) related to the movement of the nine points shown in the figure.

The points moving downwards is

A. a

B. c

C. d

D. e

Answer: A

Watch Video Solution

2. The figure represents the instantaneous picture of a transverse harmonic wave traveling along the negative x-axis. Choose the correct alternative(s) related to the movement of the nine points shown in the figure.

The points moving downwards is

A. o

B. b

C. d

D. h

Answer: C

Watch Video Solution

3. The figure represents the instantaneous picture of a transverse harmonic wave traveling along the negative x-axis. Choose the correct alternative(s) related to the movement of the nine points shown in the figure.

The points moving downwards is

A. o

B. b

C. g

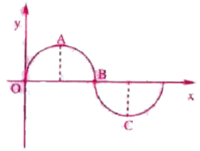
D. h

Answer: B

Watch Video Solution

PRACTICE SHEET (EXERCISE -I) (GENERAL WAVE EQUATION) (LEVEL-II ADVANCED) (MATRIX MATCHING TYPE QUESTIONS)

1. Snapshot of a string carrying a progressive wave is shown in figure at time t = 0. The wave moves along positive x - axis:



Column - I	Column - II
A) At point'O'	p) Speed of the particle is maximum
B) At point 'A'	q) Strain is maximum
C) At point 'B'	r) Tension in the string is minimum
D) At point 'C'	s) Velocity of the particle is directed down wards

Watch Video Solution

PRACTICE SHEET (EXERCISE -I) (GENERAL WAVE EQUATION) (LEVEL-II ADVANCED) (INTEGER TYPE QUESTIONS)

1. The displacement y of a wave travelling in the x-direction is given by $y = 10^{-4}\sin\left(600t - 2x + \frac{\pi}{3}\right)$ metre. Where, x is expressed in metres and t in seconds. The speed of the wave-motion, in ms^{-1} is

Watch Video Solution

2. A wave travelling along the x-axis is described by the equation $y(x, t) = 0.005\cos(\alpha x - \beta t)$. If the 1wavelength and the time period of the wave are 0.08m and 2.0s, respectively, then $\frac{\alpha}{\beta} = n \times 5$, then the value of n is____(where α, β are in appropriate units).

Watch Video Solution

3. The equation of a wave is $y = 4\sin\left\{\frac{\pi}{2}\left(2t + \frac{x}{8}\right)\right\}$ where y , x are in cm and time in seconds. The phase difference between two position of the same particle which are occupied at time interval of 0.4 s is $x\pi \times 10^{-1}$, what is the value of x ?

Watch Video Solution

PRACTICE SHEET (EXERCISE -II) (WAVE SPEED, ENERGY, POWER & INTENSITY AND SUPERPOSITION PRINCIPLE) (LEVEL -I MAIN)(STRAIGHT OBJECTIVE TYPE QUESTIONS)

1. A transverse wave propogations on a stretched string of linear density 3×10^{-4}kg/m is represented by equation y = 0.2 Sin(1.5x + 60 t) where 'x' is in meters and 't' is in seconds. The tension in string (in newtons) is

A. 0.24

B. 0.48

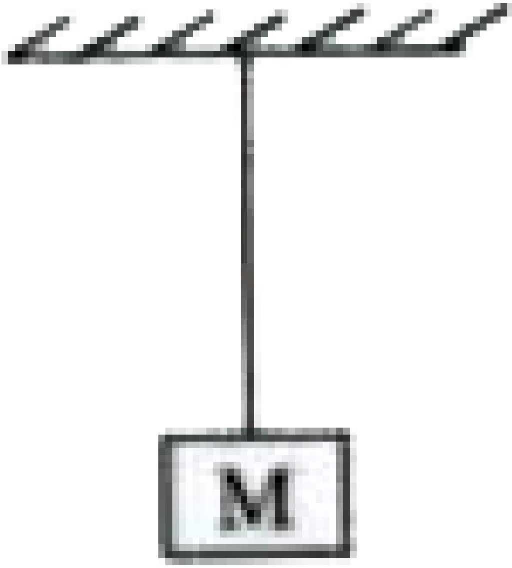
C. 1.2

D. 1.8

Answer: B

Watch Video Solution

2. A load of mass M is attached to the free and of a uniform wire of mass m as shown in figure. If a transverse wave pulse is generated at the lower end of wire, find the ratio of velocity of wave at bottom end and at top end of wire



A. $\frac{M}{M+m}$

B. $\sqrt{\frac{M}{M+m}}$

C. $\frac{M+m}{M}$

D. $\sqrt{\frac{M+m}{M}}$

Answer: B

Watch Video Solution

PRACTICE SHEET (EXERCISE -II) (WAVE SPEED, ENERGY, POWER & INTENSITY AND SUPERPOSITION PRINCIPLE) (LEVEL -II ADVANCED) (STRAIGHT OBJECTIVE TYPE QUESTIONS)

1. A string of length L consists of two distinct sections. The left half has linear mass density $\mu_1 = \mu_0/2$ while the right half has linear mass density $\mu_2 = 3\mu_0$. Tension in the string is F_0 . The time required for a transverse wave pulse to travel from one end of the string to the other is

A. $\frac{L}{4}\sqrt{\frac{\mu_0}{F_0}}\left(\sqrt{2}+\sqrt{6}\right)$

B. $\frac{L}{2}\sqrt{\frac{2\mu_0}{f_0}}\left(1+\sqrt{3}\right)$

C. $\frac{L}{2}\sqrt{\frac{\mu_0}{2F_0}}\left(\sqrt{2}+\sqrt{6}\right)$

D. $\frac{L}{2}\sqrt{\frac{\mu_0}{2F_0}}\left(1+\sqrt{6}\right)$

Answer: D

Watch Video Solution

2. A transverse wave is tranvelling in a string at any moment a small element 'dx' is at inclination 30° with the direction of propagation of the wave. After some time interval its inclination changes to 60° with direction of propagation. Potential energy of this small element is initially U_0 and finally it is KU_0, value of K is

A. 2

B. 9

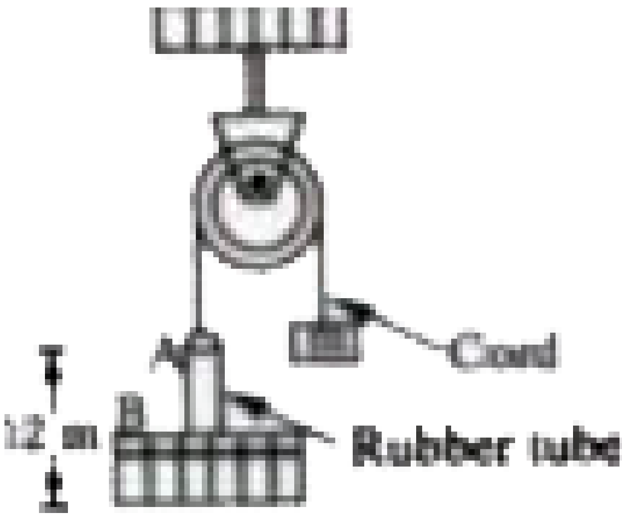
C. 3

D. 4

Answer: B

Watch Video Solution

3. A long rubber tube having mass 0.9kg is fastened to a fixed support and the free end of the tube is attached to a cord which passase over a pulley and supports an object, with a mass of 5 kg as shown in fig. If the tube is struck by a transvers blow at one end, the time required for the pulse to reach the 49 other end is (linear density of tube $= \frac{49}{625} kg/m$)



A. 5s

B. 0.47 s

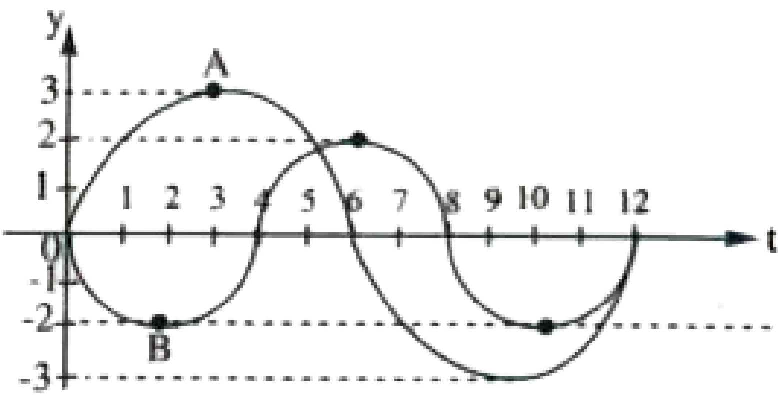
C. 4.7 s

D. 3.2 s

Answer: B

Watch Video Solution

4. The transversal displacement V_s time graph for two waves A and B which travel along the same string are shown in the figure. Their average intensity ratio I_A/I_B is



A. $\frac{9}{4}$

B. 1

C. $\frac{81}{16}$

D. $\frac{3}{2}$

Answer: D

Watch Video Solution

5. Two harmonic waves travelling in the same medium have frequency in the ratio 1:2 and intensity in the ratio 1:36. Their amplitude ratio is

(a) $1:6$

(b) $1:8$

(c) $1:72$

(d) $1:3$

A. $1:6$

B. $1:8$

C. $1 : 72$

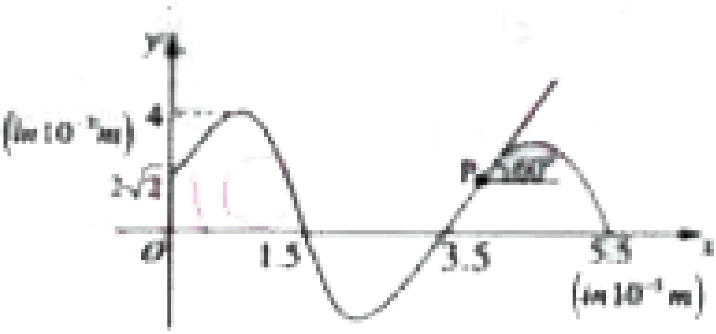
D. $1, 3$

Answer: C::D

Watch Video Solution

PRACTICE SHEET (EXERCISE -II) (WAVE SPEED, ENERGY, POWER & INTENSITY AND SUPERPOSITION PRINCIPLE) (LEVEL -II ADVANCED) (MORE THAN ONE CORRECT ANSWER TYPE QUESTIONS)

1. The figure shows a snap photogaraph of a vibrating string at t = 0. The particle P is observed moving up with velocity $2\sqrt{3}$ cm/s. The tangent at P makes an angle 60° with x-axis. The mass per unit length of string is 50 g/m



A. wave is moving along positive x-direction

B. The equation of the wave is $y = 0.4\sin\left(10\pi t - \frac{\pi}{2}x\right)$

C. Total energy carried by the wave per cycle of the striiig is 1.6×10^{-5} J

D. The equation of the wave is $y = 4mm\sin\left(10\pi t + \frac{\pi}{2}x + \frac{\pi}{4}\right)$

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

Watch Video Solution

2. A simple harmonic wave has the equation $y_1 = 0.3\sin(314t - 1.57x)$ and another wave has equation $y_2 = 0.1\sin(314t - 1.57x + 1.57)$ where x, y_1 and y_2 are in metre and t is in second.

A. $v_1 = v_2 = 50Hz$

B. $\lambda_1 = \lambda_2 = 4m$

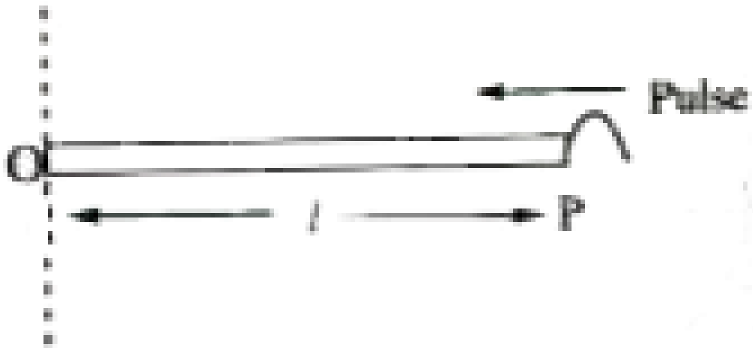
C. Ratio of intensity is 9

D. y_2 leads y_1 by a phase angle of $\frac{\pi}{2}$.

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

Watch Video Solution

3. A metallic rod of length l, linear mass density W rotates about one of it's end 'O' in a smooth horizontal plane with an angular velocity w about an end axis which is perpendicular to plane of rotation shown in figure. A transverse pulse generated at the free end P to reach the axis of rotation. (neglect the gravitational effect)



A. The speed of the transverse pulse just after generated at the free end point P with respect to ground is $l\omega$

B. The speed of the transverse pulse when it reaches the mid point of string with respect to ground us $\frac{\sqrt{5}l\omega}{\sqrt{8}}$

C. The tension in the string at a distance .x. from the free and $\frac{\mu\left[L^2 - (L - x)^2\right]}{2}\omega^2$

D. The time taken by the transverse pulse to reach the axis of rotation from free end is $\frac{\pi}{\sqrt{2}\omega}$

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

Watch Video Solution

4. Consider a harmonic wave travelling on a string of mass per unit length mu. The wave has a velocity v, amplitude A and frequency if. The power transmitted by a harmonic wave on the string is proportional to (take constant of proportionality as $2\pi^2$)

A. μ

B. v

C. A^2

D. f^2

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

Watch Video Solution

PRACTICE SHEET (EXERCISE -II) (WAVE SPEED, ENERGY, POWER & INTENSITY AND SUPERPOSITION PRINCIPLE) (LEVEL -II ADVANCED) (LINKED COMPREHENSION TYPE QUESTIONS) (PASSAGE-I)

1. One end of a 60m long rope of mass 1.8 kg is tied to a rigid horizontal support held high above the ground. The rope hangs vertically and kept taut by a weight 'W' suspended at its lower end. A person jerks the lower end of the rope sideways in a sinusoidal manner and a transverse wave of frequency 2 Hz and amplitude 10cm passes along the rope such that there are 2 cycles of the wave in the total length of the rope. Neglecting the weight of the rope as compared to the suspended weight W and with g = 10m/s2, answer the following questions. $\left(S = 75 \times 10^{-4} m^2\right)$

In the questions above, weight of the rope has been neglected as compared to the suspended weight. However, if we also account for the weight of the rope. the speed of the wave at the top of the rope will be

A. 14.2kg

B. 10.8kg

C. 6.6kg

D. 8.4k

Answer: B

Watch Video Solution

2. One end of a 60m long rope of mass 1.8 kg is tied to a rigid horizontal support held high above the ground. The rope hangs vertically and kept taut by a weight 'W' suspended at its lower end. A person jerks the lower end of the rope sideways in a sinusoidal manner and a transverse wave of frequency 2 Hz and amplitude 10cm passes along the rope such that there are 2 cycles of the wave in the total length of the rope. Neglecting the weight of the rope as compared to the suspended weight W and with g = 10m/s2, answer the following questions. $\left(S = 75 \times 10^{-4} m^2\right)$

In the questions above, weight of the rope has been neglected as compared to the suspended weight. However, if we also account for the weight of the rope. the speed of the wave at the top of the rope will be

A. 3.2 w

B. 2.25 w

C. 1.4 w

D. 0.75 w

Answer: A

Watch Video Solution

3. One end of a 60m long rope of mass 1.8 kg is tied to a rigid horizontal support held high above the ground. The rope hangs vertically and kept taut by a weight 'W' suspended at its lower end. A person jerks the lower end of the rope sideways in a sinusoidal manner and a transverse wave of frequency 2 Hz and amplitude 10cm passes along the rope such that there are 2 cycles of the wave in the total length of the rope. Neglecting the weight of the rope as compared to the suspended weight W and with g = 10m/s2, answer the following questions. $\left(S = 75 \times 10^{-4} m^2\right)$

In the questions above, weight of the rope has been neglected as compared to the suspended weight. However, if we also account for the weight of the rope. the speed of the wave at the top of the rope will be

A. 60 m/s

B. 64.8 m/s

C. 62.6 m/s

D. 68.4 m/s

Answer: B

Watch Video Solution

PRACTICE SHEET (EXERCISE -II) (WAVE SPEED, ENERGY, POWER & INTENSITY AND SUPERPOSITION PRINCIPLE) (LEVEL -II ADVANCED) (INTEGER TYPE QUESTIONS)

1. A copper wire is held at the two ends by rigid supports. At $30\,^{\circ}C$, the wire is just taut with negligible tension, Find the speed of transverse wave in the wave at $10\,^{\circ}C$. Given : Coefficient of linear expansion is $1.7 \times 10^{-5} l\,^{\circ}C$ Young's modulus $= 1.3 \times 10^{11} \text{N/m}^2$ Density $= 9 \times 10^3 \text{ kg m}^{-3}$.

Watch Video Solution

PRACTICE SHEET (EXERCISE -III) (REFLECTION, TRANSMISSION OF WAVES AND STANDING WAVES) (LEVEL-I MAIN)(STRAIGHT OBJECTIVE TYPE QUESTIONS)

1. The length of a sonometer wire tuned to a frequency of-256 Hz is 0.6 m. Calculate the frequency of the tuning fork with which the vibrating wire will be in tune when the length is made 0.4 m.

A. 78 Hz

B. 512 Hz

C. 384 Hz

D. 126 Hz

Answer: C

Watch Video Solution

2. The fundamental frequency of a string stretched with a weight of 4 kg is 256 Hz. The weight required to produce its octave is

A. 4 kg wt

B. 12 kg wt

C. 16 kg wt

D. 24 kg wt

Answer: C

Watch Video Solution

3. A wire having a linear mass density $5.0 \times 10^{-3} kg/m$ is stretched between two rigid supports with a tension of 450 N. The wire resonates at a frequency of 420 Hz. The next higher frequency at which the same wire resonates is 490 Hz. Find the length of the wire.

A. 1.2 m

B. 1.8 m

C. 2.1 m

D. 8.1 m

Answer: C

Watch Video Solution

4. In order to double the frequnecy of the fundamental note emitted by a stratched string the length is reduced to $\frac{3}{4}$ th of the original length and the tension is changed. The factor by which the tension is to be changed is

A. $\frac{3}{8}$

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

C. $\frac{8}{9}$

D. $\frac{9}{4}$

Answer: D

Watch Video Solution

5. 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. $2:1$

C. $1:\sqrt{2}$

D. $\sqrt{2}:1$

Answer: D

Watch Video Solution

Watch Video Solution

6. Two uniform strings A and B made of steel are made to vibrate under the same tension. If the first overtone of A is equal to the second overtone of B and if the radius of A is twice that of B, the ratio of the lengths of the strings is

A. $1:2$

B. $1:3$

C. $1:4$

D. $1:5$

Answer: B

Watch Video Solution

7. A wave of frequency 100Hz is sent along a string towards a fixed end. When this wave traveles back then after reflection, a node is formed at a minimum distance of 10 cm from the fixed end of the string. The speed of the incident wave is.

A. 40 m/s

B. 20 m/s

C. 10 m/s

D. 5 m/s

Answer: B

Watch Video Solution

8. Two strings of the same material and the same area of cross - section are used in sonometer experiment. One is loaded with 12kg and the other with 3 kg. The fundamental frequency of the first string is equal to the first overtone of the second string. If the length of the second string is 100 cm, then the length of the first string is

A. 300 cm

B. 200 cm

C. 100 cm/s

D. 50 cm

Answer: C

Watch Video Solution

9. The equation of a stationary wave is $y = 4\sin\left(\frac{\pi x}{5}\right)\cos(100\pi t)$. The wave is formed using a string of length 20cm. The second and 3rd antipodes are located at positions (in cm)

A. 7.5, 12.5

B. 2.5, 7.5

C. 12.5, 17,5

D. 5, 10

Answer: A

Watch Video Solution

10. Two transverse waves A and B superimposed to produce a node at x = 0. If the equation of wave A si $y = a\cos(kx - \omega t)$, then the equation of wave B is

A. y = a sin (wt+kx)

B. y = acos (kx-wt)

C. y = -a cos (kx-wt)

D. y = -a sin (kx+wt)

Answer: D

Watch Video Solution

PRACTICE SHEET (EXERCISE -III) (REFLECTION, TRANSMISSION OF WAVES AND STANDING WAVES) (LEVEL-II ADVANCED) (STRAIGHT OBJECTIVE TYPE QUESTIONS)

1. A composition string is made up by joining two strings of different masses per unit length 1g/ m and 4 g/m. The composite string is under the same tension. A transverse wave pulse : Y = (6 mm) sin(5t + 40x), where it is in seconds and 'x' in meters, is sent along the lighter string towards the joint. The joint is at x = 0. The equation of the wave pulse reflected from the joint is

A. (2 mm) sin(5t - 40x)

B. (4 mm) sin(40 x - 5t)

C. $-(2mm)\sin(5t - 40x)$

D. (2 mm) sin (5t - 10a)

Answer: C

Watch Video Solution

2. A stiff wire is bent into a cylinder loop of diameter D. It is clamped by knife edges at two points opposite to each other . A transverse wave is sent around the loop by means resonance frequency (fundamental mode) of the loop in terms of wave speed v and diameter D is

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

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

C. $\frac{v}{\pi D}$

D. $\frac{v}{2\pi D}$

Answer: C

Watch Video Solution

3. 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

Watch Video Solution

4. Find the tension needed to produce stationary waves with 4 loops in a string 1m long and 0.5 gram in weight, fixed to a tuning fork of frequency 200Hz, when the prongs of the fork are vibrating perpendicular to the string.

A. 5 N

B. 10 N

C. 15 N

D. 0.5 N

Answer: A

Watch Video Solution

5. The fundatmental frequency of a sonometer wire increases by $6Hz$ if its tension is increased by 44% keeping the length constant. Find the change in the fundamental frequency of the sonometer when the length of the wire is increased by 20% keeping the original tension in the wire.

A. 4 Hz

B. 7 Hz

C. 5 Hz

D. 3 Hz

Answer: C

Watch Video Solution

6. A wire of density $9 \times 10^3 kg/m^2$ is stretched between two clamps 1 m apart and is subjected to an extesion of $4.9 \times 10^{-4} m$. What will be the lowest frequency of transverse vibrations in the wire ?

A. 25 Hz

B. 35 Hz

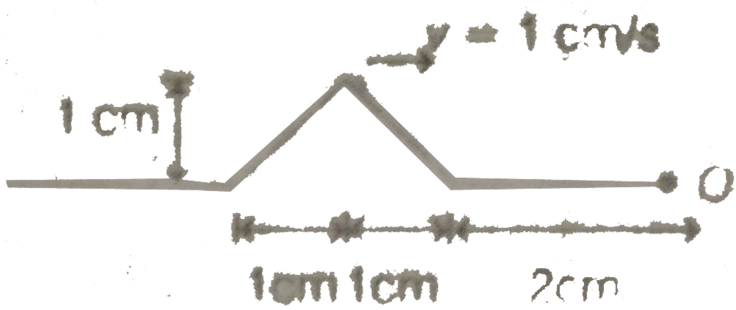
C. 15 Hz

D. 45 Hz

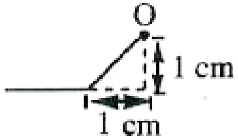
Answer: B

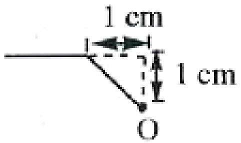
Watch Video Solution

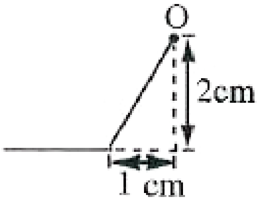
7. A wave pulse on a string on a string has the dimension shown in figure. The wave speed is v=1 cm /s . If point O is a free end. The shape of wave at time t = 3s si



A.

B. 

C. 

D. 

Answer: D

Watch Video Solution

PRACTICE SHEET (EXERCISE -III) (REFLECTION, TRANSMISSION OF WAVES AND STANDING WAVES) (LEVEL-II ADVANCED) (MORE THAN ONE CORRECT ANSWER TYPE QUESTIONS)

1. Two wires of different densities are soldered together end to end then stretched under tension T. The waves speed in the first wire is twice that in the second wire.

(a) If the amplitude of incident wave is A, what are amplitudes of reflected and transmitted waves?

(b) Assuming no energy loss in the wire, find the fraction of the incident power that is reflected at the junction and fraction of the same that is transmitted.

A. $y_r = A_r \sin(\omega t + k_1 x)$

B. $y_1 = A_1 \sin(\omega t - k_2 x)$

C. $A_t = \frac{k_1 - k_2}{k_1 + k_2} A_i$

D. $A_t = \frac{2k_1}{k_1 + k_2} A_i$

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

Watch Video Solution

2. Two waves of nearly same amplitude , same frequency travelling with same velocity are superimposing to give phenomenon of interference . If a_1 and a_2 be their respectively amplitudes , ω be the frequency for both , v be the velocity for both and $\Delta\phi$ is the phase difference between the two waves then ,

A. the resultant intensity varies periodically with time and distance.

B. the resultant intensity with $\frac{I_{\text{min}}}{I_{\text{max}}} = \left(\frac{a_1 - a_2}{a_1 + a_2}\right)^2$ is obtained.

C. both the waves must have been travelling in the same direction and must be coherent.

D. $I_s = I_1 + I_2 + 2\sqrt{I_1 I_2}\cos(\Delta\pi)$ where constrictive interference is obtained for path differences that are even multiple of $\frac{1}{2}\lambda$ and destructive interference is obtained for path differences that are odd multiple of $\frac{1}{2}\lambda$.

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

Watch Video Solution

3. Along the straight line joining two consecutive displacement nodes in a pure stationary sound wave at different points

A. the S.H.M.s will be in different phases

B. Velocities are in phase

C. the accelerations are inphase

D. frequencies are equal

Answer: B::C::D

Watch Video Solution

4. A wire of density $9 \times 10^3 kg/m^3$ is stretched between two clamps $1m$ apart and is stretched to an extension of $4.9 \times 10^{-4} m$. Young's modulus of material is $9 \times 10^{10} N/m^2$.

A. The lowest frequency of standing wave is 35 Hz

B. The frequency of 1st overtone is 70Hz

C. The frequency of 1st overtone is 105 Hz

D. The lowest frequency of standing wave is 70Hz

Answer: A::B

Watch Video Solution

5. In which case is the power being delivered by a given progressive sinusoidal wave on a given string is doubled? Material of the string is unchanged.

A. The wave amplitude is doubled (keeping the frequency the same).

B. The wave frequency is cut in half (keeping the amplitude the same).

C. Tension in the string is made four times the initial value (keeping its linear density, amplitude and frequency the same).

D. The diameter of the string is doubled (keeping the tension amplitude and frequency the same).

Answer: C::D

Watch Video Solution

PRACTICE SHEET (EXERCISE -III) (REFLECTION, TRANSMISSION OF WAVES AND STANDING WAVES) (LEVEL-II ADVANCED) (LINKED COMPREHENSION TYPE QUESTIONS) (PASSAGE-I)

1. A string vibrates according to the equation $y = 5\sin\frac{\pi x}{3}\cos 40\pi t$

where, x and y are in centimeters and t is in seconds.

(a) What is the speed of the component wave?

(b) What is the distance between the adjacent nodes?

(c) What is the velocity of the particle of the string at the position $x = 1.5$ cm when $t = \frac{9}{8}s$?

A. 2.5 cm, $1.2ms^{-1}$

B. $1cm, 2.5ms^{-1}$

C. $1.5cm, 2.5ms^{-1}$

D. $2cm, 3.5ms^{-1}$

Answer: A

Watch Video Solution

2. A stationary wave is given by $y = 5\frac{\sin(\pi x)}{3}\cos 40\pi t$ where x and y are in cm and t is in seconds

What is the distance between two successive nodes

A. 0.01 m

B. 0.02 m

C. 0.03 m

D. 0.04 m

Answer: C

Watch Video Solution

3. A stationary wave is given by $y = 5\frac{\sin(\pi x)}{3}\cos 40\pi t$ where x and y are in cm and t is in seconds

What is the velocity of a particle of the string at the position x = 1.5 cm when $t = \frac{9}{8}s$

A. 0

B. $1ms^{-1}$

C. $2ms^{-1}$

D. $3ms^{-1}$

Answer: A

Watch Video Solution

PRACTICE SHEET (EXERCISE -III) (REFLECTION, TRANSMISSION OF WAVES AND STANDING WAVES) (LEVEL-II ADVANCED) (MATRIX MATCHING TYPE QUESTIONS)

1. A wave disturbance in a medium is described by $Y = 0.02\cos\left(50\pi t + \frac{\pi}{2}\right)\cos\pi x$. Where x and y are in m and t in sec. The values in Column-II are in SI units.

Column - I	Column - II
A) Node occurs at	p) 0.5 m
B) Antinode occurs at	q) 50 m/s
C) speed of wave	r) 2 m
D) wave length	s) 1 m

Watch Video Solution

2. A sonometer wire resonates with a given tuning fork forming standing waves with three antinodes between the two bridges when a mass of 16 Kg is suspended from the wire. When this mass is replaced by a mass .9 kg. the wire resonates with the same tuning fork for .p. antinodes for the same positions of the bridges. Then .p. is

Watch Video Solution

PRACTICE SHEET (EXERCISE -III) (REFLECTION, TRANSMISSION OF WAVES AND STANDING WAVES) (LEVEL-II ADVANCED) (INTEGER TYPE QUESTIONS)

1. A stretched string is taken and stretched such that elongated by 1% then the fundamental frequency decreased by $x \times 10^{-1}\%$ what is the value of x ?

Watch Video Solution

PRACTICE SHEET (EXERCISE -IV) (SPEED OF SOUND, INTENSITY OF SOUND, INTEFERENCE OF SOUND WAVES) (LEVEL-I MAIN) (STRAIGHT OBJECTIVE TYPE QUESTIONS)

1. The ratio of the speed of sound in nitrogen gas to that in helium gas, at 300 K is

A. $\sqrt{2/7}$

B. $\sqrt{1/7}$

C. $\sqrt{3}/5$

D. $\sqrt{6}/5$

Answer: C

Watch Video Solution

2. The velocities of sound in an ideal gas at temperature T_1 and T_2K are found to be V_1 and V_2 respectively. If the r.m.s velocities of the molecules of the same gas at the same temperatures T_2 and T_2 are v_1 and v_2 respectively then

A. $v_2 = v_1\left(V_1/V_2\right)$

B. $v_2 = v_1\left(V_2/V_1\right)$

C. $v_2 = v_1\sqrt{V_2/V_1}$

D. $v_2 = v_1\sqrt{V_1/V_2}$

Answer: B

Watch Video Solution

3. The speed of sound in oxygen (O_2) at a certain temperature is $460ms^{-1}$. The speed of sound in helium (He) at the same temperature will be (assumed both gases to be ideal)

A. $1420ms^{-1}$

B. $500ms^{-1}$

C. $650ms^{-1}$

D. $330ms^{-1}$

Answer: A

Watch Video Solution

4. A man standing at some distance from a cliff hears the echo of sound after 2s. He walks 495 m away from the cliff. He produces a sound there and receives the echo after 5s. What is the speed of sound?

A. 330 m/s

B. 340 m/s

C. 390 m/s

D. 380 m/s

Answer: A

Watch Video Solution

5. 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

6. If the sound level in a room is increased from 50dB to 60 dB, by water factor is the pressure amplitude increased ?

A. 10

B. $\sqrt{10}$

C. 10^{-6}

D. 10^{-7}

Answer: B

Watch Video Solution

7. A window whose area is $2m^2$ opens on street where the street noise result in an intensity level at the window of 60 dB. How much acoustic power enters the window via sound waves. Now if an acoustic absorber is fitted at the window, how much energy from street will it collect in 5 h?

A. $26 \times 10^{-13} J$

B. 26×10^{-10} J

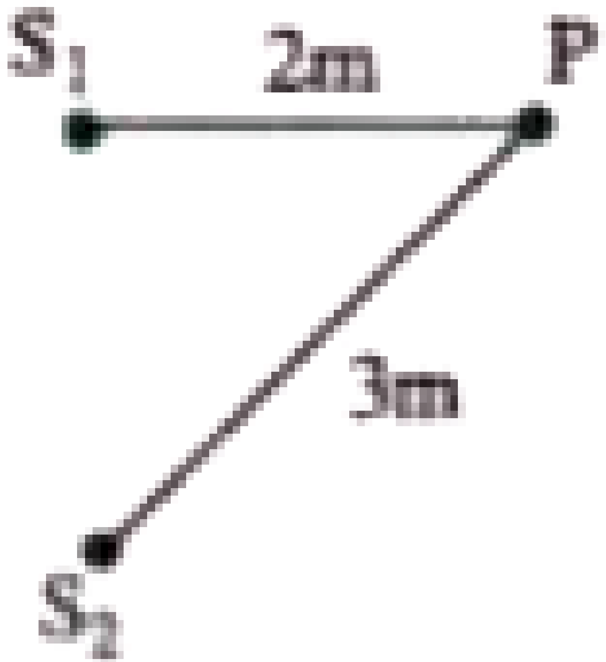
C. $36 \times 10^{-3} J$

D. $46 \times 10^{-10} J$

Answer: C

Watch Video Solution

8. Two identical speakers emit sound waves of frequency 660Hz uniformly in all directions. The audio output of each speaker is 1mW and the speed of sound in air. A point P is a distance 2m from one speaker and 3m from the other. If they are driven coherently but out of phase by 180°, the intensity at the point 'P' is



A. $55.3 \mu W/m^2$

B. $2.2 \mu W / m^2$

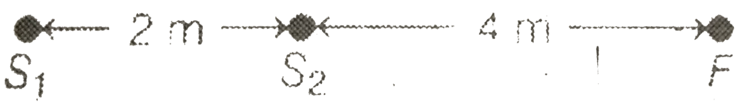
C. $28.7 \mu W / m^2$

D. $6.3 \mu W / m^2$

Answer: B

Watch Video Solution

9. S_1 and S_2 are two sources of sound etmitting sine waves. The two sources are in phase. The sound emitted by the two sources interfere at point F. The waves of wavelength



A. 1m will result in constructive interference

B. 2/3 m will result in constructive interference

C. 2m will result in destructive interference

D. 4m will result in destructive interference

Answer: C

Watch Video Solution

10. Two speakers S_1 and S_2 , placed 1m apart, each produce sound waves of frequency 1800 Hz in phase. A detector moving parallel to line of speakers distant 2.4 m away detects a maximum intensity at O and 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

PRACTICE SHEET (EXERCISE -IV) (SPEED OF SOUND, INTENSITY OF SOUND, INTEFERENCE OF SOUND WAVES) (LEVEL-II ADVANCED) (STRAIGHT OBJECTIVE TYPE QUESTIONS)

1. The ratio of densities of nitrogen and oxygen is 14 : 16. The temperature at which the speed of sound in nitrogen will be same as that in oxygen at $55^\circ C$ is

A. $35^\circ C$

B. 48° C

C. 65° C

D. 14° C

Answer: D

Watch Video Solution

2. A tuning fork produces a wave of wavelength 110 cm in air at $0^{\circ}C$. The wavelength at $25^{\circ}C$ would be

A. 110 cm

B. 115 cm

C. 120 cm

D. 130 cm

Answer: B

Watch Video Solution

3. A road runs midway between two parallel rows of buildings. A motorist moving with a speed of 36 Km/h sounds the horn. He hears the echo one second after he has sounded the horn: Then the distance between the two rows of buildings is. (Velocity of sound in air is 330 m/s)

A. $80\sqrt{17}m$

B. $40\sqrt{17}$m

C. $30\sqrt{10}$m

D. $34\sqrt{10}m$

Answer: A

Watch Video Solution

4. A mixture of diatomic gases is obtained by mixing m_1 and m_2 masses of two gases, with velocity of sound in them c_1 and c_2 respectively. Determine the velocity of sound in the mixture of gases. (Temperature of the gas remains constant)

A. $c = \sqrt{\dfrac{m_1c_2^2 - m_2c_1^2}{m_2 + m_1}}$

B. $c = \sqrt{\dfrac{m_1c_2^2 + m_2c_1^2}{m_1 + m_2}}$

C. $c = \sqrt{\dfrac{m_1c_1^2 + m_2c_2^2}{m_2 + m_1}}$

D. $c = \sqrt{\dfrac{m_1c_2^2 + m_2c_1}{m_1 - m_2}}$

Answer: C

Watch Video Solution

5. A point A is located at a distance r = 1.5 m from a point source of sound of frequency 600 Hz. The power of the source is 0.8 watt. Speed in air is 340 m/s and density of air is $1.29 kg/m^3$. Find the pressure oscillation amplitude $(\Delta P)_m$

A. $4.98 N/m^2$

B. $6.98 N / m^2$

C. $2.98 N / m^2$

D. $1.98 N / m^2$

Answer: A

Watch Video Solution

PRACTICE SHEET (EXERCISE -IV) (SPEED OF SOUND, INTENSITY OF SOUND, INTEFERENCE OF SOUND WAVES) (LEVEL-II ADVANCED) (MORE THAN ONE CORRECT ANSWER TYPE QUESTIONS)

1. A sound wave propagates in a medium of Bulk modulus B by means of compressions and rare fractions. If P_c and P_e are the pressures at compression and rarefaction respectively, .a. be the wave amplitude and k be the angular wave number then,

A. P_c is maximum and P_r is minimum.

B. P_c is minimum and P_r is maximum

C. the pressure amplitude is Bak

D. if the displacement wave is $Y = a\sin(\omega t - kx)$, the pressure wave at an instant is represented as $\frac{P_c - P_r}{2}\cos(\omega t - kx)$ Which leads displacement wave by a phase angle of $\pi/2$.

Answer: A::C::D

Watch Video Solution

2. A source is moving across a circle given by the equation $x^2 + y^2 = R^2$ with constant speed $v_S = \frac{330\pi}{6\sqrt{3}} m/s$. In clockwise sense. A detector is stationary at the point $(2R, 0) w.r.t.$ the centre of the circle. The frequency emitted by the source is f_S.

(a) What are the co-ordinates of the source when the detector records the maximum and minimum frequencies. Take speed of sound $v = 330 m/s$.

A. The position of the source when the detector records the maximum frequency $\left(+\frac{\sqrt{3}}{2}R, -\frac{R}{2}\right)$

B. The co-ordinate of the source when the detector records maximum frequency is (0, R)

C. The maximum frequency recorded by the detector is $\frac{6\sqrt{3}}{\pi + 6\sqrt{3}}f$

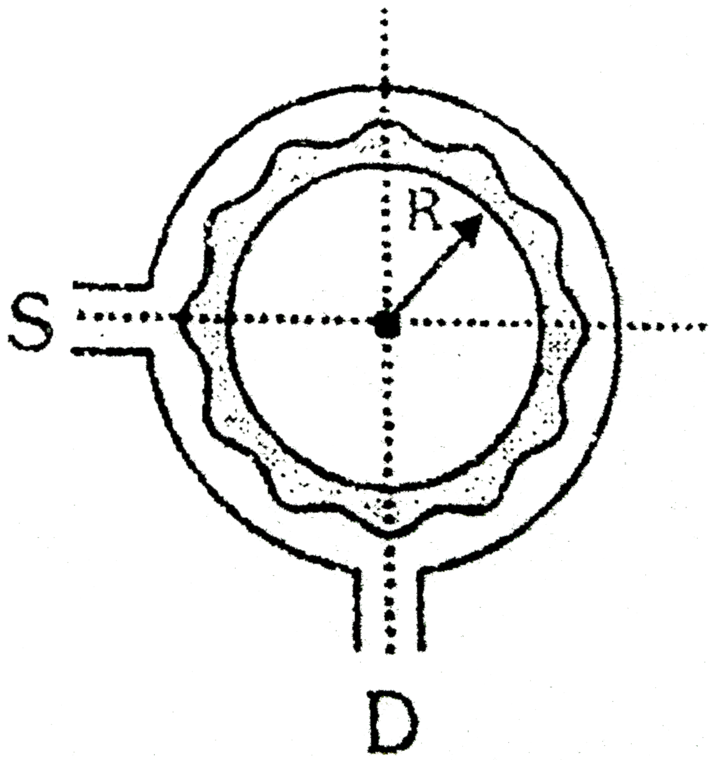
D. The minimum frequency recorded by the detector is: $\frac{6\sqrt{3}}{6\sqrt{3} - \pi}$f

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

Watch Video Solution

PRACTICE SHEET (EXERCISE -IV) (SPEED OF SOUND, INTENSITY OF SOUND, INTEFERENCE OF SOUND WAVES) (LEVEL-II ADVANCED) (LINKED COMPREHENSION TYPE QUESTIONS) (PASSAGE -I)

1. A narrow tube is bend in the form of a circle of radius R, as shown in the figure. Two small holes S and D are made in the tube at the positions right angle to each other. A source placed at S generated a wave of intensity I_0 which is equally divided into two parts : One part travels along the longer path, while the other travels along the shorter path. Both the parts wave meet at the point D where a detector is placed.



The maximum value of λ to produce a maxima at D is given by :-

A. πR

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

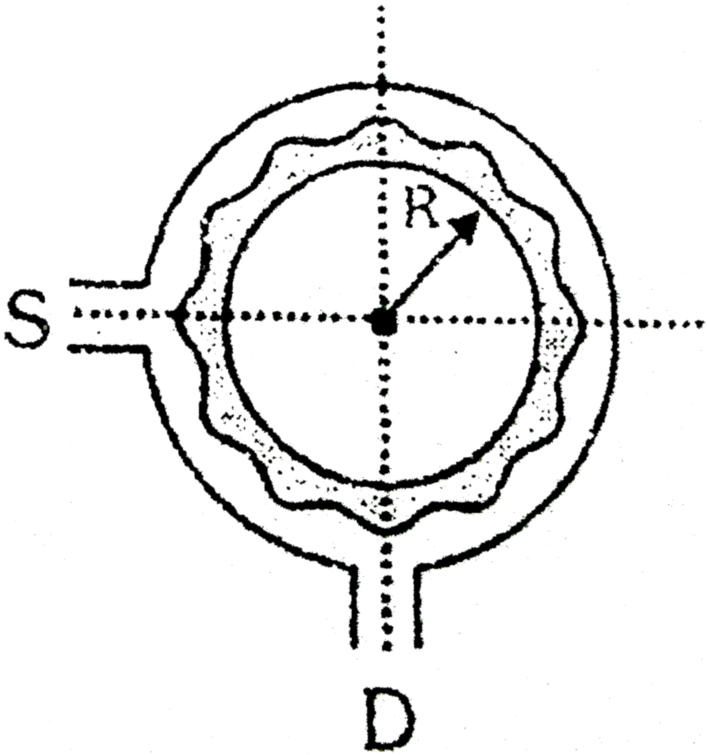
C. $\frac{\pi R}{4}$

D. All of these

Answer: D

Watch Video Solution

2. A narrow tube is bend in the form of a circle of radius R, as shown in the figure. Two small holes S and D are made in the tube at the positions right angle to each other. A source placed at S generated a wave of intensity I_0 which is equally divided into two parts : One part travels along the longer path, while the other travels along the shorter path. Both the parts wave meet at the point D where a detector is placed.



The maximum value of λ to produce a maxima at D is given by :-

A. $2\pi R$

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

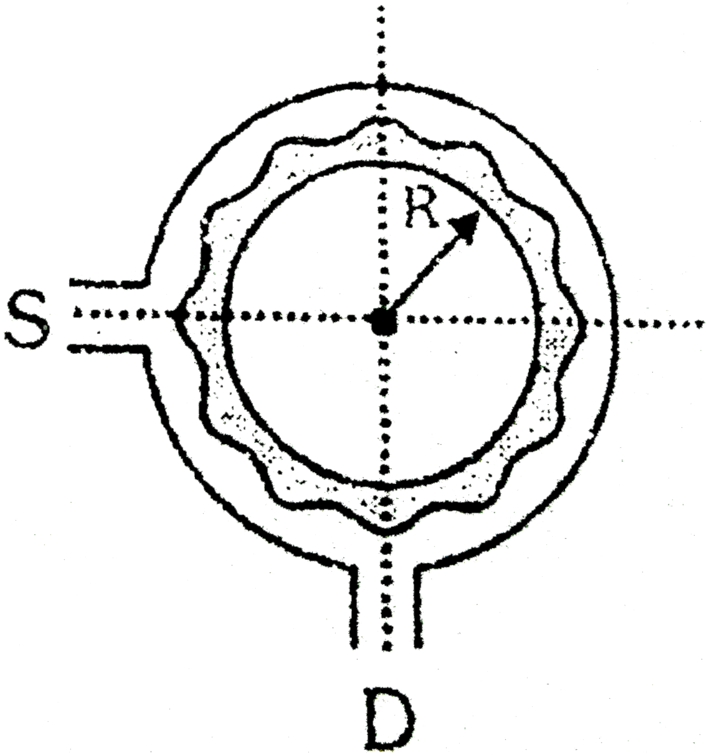
C. $\frac{2}{5}\pi R$

D. None of these

Answer: C

Watch Video Solution

3. A narrow tube is bend in the form of a circle of radius R, as shown in the figure. Two small holes S and D are made in the tube at the positions right angle to each other. A source placed at S generated a wave of intensity I_0 which is equally divided into two parts : One part travels along the longer path, while the other travels along the shorter path. Both the parts wave meet at the point D where a detector is placed.



The maximum value of λ to produce a maxima at D is given by :-

A. $4I_0$

B. $2I_0$

C. I_0

D. $3I_0$

Answer: B

Watch Video Solution

PRACTICE SHEET (EXERCISE -IV) (SPEED OF SOUND, INTENSITY OF SOUND, INTEFERENCE OF SOUND WAVES) (LEVEL-II ADVANCED) (MATRIX MATCHING TYPE QUESTIONS)

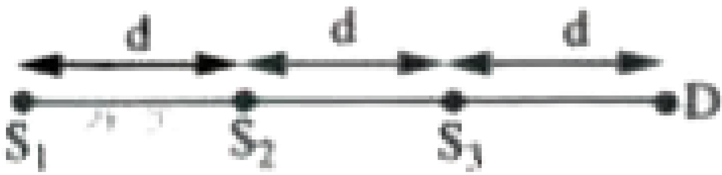
1. A wave disturbance in a medium is described by $Y = 0.02\cos\left(50\pi t + \frac{\pi}{2}\right)\cos\pi x$. Where x and y are in m and t in sec. The values in Column-II are in SI units.

Column - I	Column - II
A) Node occurs at	p) 0.5 m
B) Antinode occurs at	q) 50 m/s
C) speed of wave	r) 2 m
D) wave length	s) 1 m

Watch Video Solution

PRACTICE SHEET (EXERCISE -IV) (SPEED OF SOUND, INTENSITY OF SOUND, INTEFERENCE OF SOUND WAVES) (LEVEL-II ADVANCED) (INTEGER TYPE QUESTIONS)

1. Three coherent sources generating waves in the same phase are placed as shown. The wave length of the wave is 40×10^{-7} m. The minimum distanced (in μ m), such that intensity at point D is 9 times the intensity of each source will be ......



Watch Video Solution

PRACTICE SHEET (EXERCISE -V) (ORGAN PIPES, BEATS) (LEVEL-I MAIN) (STRAIGHT OBJECTIVE TYPE QUESTIONS)

1. An organ pipe P_1 closed at one end and vibrating in its first overtone, and another pipe P_2 open at both ends and vibrating in its third overtone, are in resonance with a given tuning fork. The ratio of the length of P_1 to that of P_2 is

A. $\frac{8}{3}$

B. $\frac{3}{8}$

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

D. $\frac{1}{3}$

Answer: B

Watch Video Solution

2. If I_1, I_2 and I_3 are wave lengths of the waves giving resonance with fundamental, first and second over tones of closed organ pipe. The ratio of wavelengths $I_1 : I_2 : I_3$ is ......

A. $1:2:3$

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

C. $1:3:5$

D. $5:3:1$

Answer: A

Watch Video Solution

3. If a resonance tube is sounded with a tuning fork of frequency 256 Hz, resonance occurs at 35 cm and 105 cm. The velocity of sound is about

A. 360 m/s

B. 512 m/s

C. 524 m/s

D. 400 m/s

Answer: B

Watch Video Solution

4. While measuring the speed of sound by performing a resonance column experiment, a student gets the first resonance condition at a column length of 18 cm during winter. Repeating the same experiment during summer, she measures the column length to be x cm for the second resonance. Then

A. $18 > x$

B. $x > 54$

C. $54 > x > 36$

D. $36 > x > 18$

Answer: C

Watch Video Solution

5. An open 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. $\frac{VX}{4l^2}$

B. $\frac{Vl^2}{2X}$

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

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

Answer: D

Watch Video Solution

6. Two progressive waves $y_1 = 4\sin 400\pi t$ and $y_2 = 3\sin 404\pi t$ moving in the same direction superpose on each other producing beats. Then the number of beats per second and the ratio of maximum to minimum intensity of the resultant waves are respectively

A. 2 and $\frac{5}{1}$

B. 4 and $\frac{49}{1}$

C. 4 and $\frac{16}{9}$

D. 2 and $\frac{49}{1}$

Answer: D

Watch Video Solution

7. Two stretched wires of same length, diameter and same material are in unison. The tension in one is increased by 2% and 2 beats per second are heard. What was the frequency of the note produced when they were in unision

A. 100 Hz

B. 200 Hz

C. 300 Hz

D. 400 Hz

Answer: B

Watch Video Solution

8. 64 tuning forks are arranged such that each fork produces 4 beats per second with next one. If the frequency of the last fork is octave of the first, the frequency of 16th fork is

A. 316 Hz

B. 322 Hz

C. 312 Hz

D. 308 Hz

Answer: C

Watch Video Solution

9. Three sound waves of equal amplitudes have frequencies (v-1), v, (v+1). They superpose to give beats. The number of beast produced per second will be:

A. 3

B. 2

C. 1

D. 4

Answer: C

Watch Video Solution

10. The fundamental frequencies of a closed pipe and an open pipe of different lengths are 300 Hz and 400 Hz respectively. If they are joined to form a longer pipe, the fundamental frequency of the long pipe so formed is

A. 350 Hz

B. 50 Hz

C. 120 Hz

D. 100 Hz

Answer: C

Watch Video Solution

11. A glass tube of $1.0m$ length is filled with water . The water can be drained out slowly at the bottom of the tube . If a vibrating tuning fork of frequency $500c/s$ is brought at the upper end of the tube and the velocity of sound is $330m/s$, then the total number of resonances obtained will be

A. 4

B. 3

C. 2

D. 1

Answer: B

Watch Video Solution

12. The frequency of a stretched uniform wire under tension is in resonance with the fundamental frequency of a closed tube. If the tension in the wire is increased by 8 N, It is in resonance with the . first overtone of the closed tube. The initial tension in the wire is

A. 1 N

B. 4 N

C. 8 N

D. 16 N

Answer: A

Watch Video Solution

13. 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. 30 Hz

B. 13.33 Hz

C. 16.67 Hz

D. 40 Hz

Answer: C

Watch Video Solution

14. The string of a sonometer is divided into two parts with the help of a wedge. The total length of the string is 1 m and the two parts differ by 2mm. When sounded together they produced two beats per second. The frequencies of the notes emitted by the two parts are

A. 499 & 497 Hz

B. 501 & 499 Hz

C. 501 & 503 Hz

D. none

Answer: B

Watch Video Solution

15. Two uniform wire are vibrating simultaneously in their fundamental modes. The tensions, lengths, diameters, and the densities of the two wires are in the ratios, 8:1 , 36:35 , 4:1 , 1:2

respectively. If the note of higher pitch has a frequency of 360Hz the number of beats produced per second is

A. 5

B. 10

C. 15

D. 20

Answer: B

Watch Video Solution

PRACTICE SHEET (EXERCISE -V) (ORGAN PIPES, BEATS) (LEVEL-II ADVANCED) (STRAIGHT OBJECTIVE TYPE QUESTIONS)

1. In a closed end pipe of length $105cm$, standing waves are set up corresponding to the third overtone . What distance from the closed end, amongst the following is a pressure node?

A. 20 cm

B. 60 cm

C. 85 cm

D. 45 cm

Answer: D

Watch Video Solution

2. 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

3. A long tube open at the top is fixed verticallly and water level inside the tube can be moved up or down . A vibrating tuning fork is held above the open end and the water level is pushed down gradually so as to get first and second resonance at $24.1cm$ and $74.1cm$, respectively below the open end . The diameter of the tube is

A. 2 cm

B. 3 cm

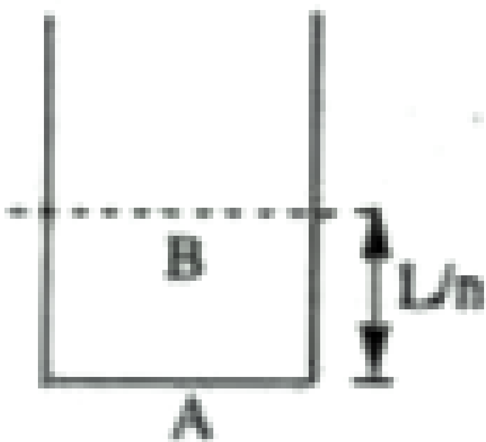
C. 4 cm

D. 5 cm

Answer: B

Watch Video Solution

4. A closed organ pipe is vibrating in fundamental frequency. There are two points A and B in the organ pipe as shown, at a distance AB = L/n. Ratio of maximum pressure variation at point A to point B is $2/\sqrt{3}$ find value of n



A. 3

B. 6

C. $\sqrt{3}$

D. 2

Answer: A

Watch Video Solution

5. A closed organ pipe of radius r_1 and an open organ pipe of radius r_2 both having same length 'L' resonate when excited with a given tunning fork. Closed organ pipe resonates in its fundamental mode where as open organ pipe resonates in its overtone , then

A. $r_2 - r_1 = L$

B. $r_2 - r_1 = L/2$

C. $r_2 - 2r_1 = 2.5L$

D. $2r_2 - r_1 = 2.5L$

Answer: C

Watch Video Solution

6. 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. $2\left(I_2 - I_1\right)$

B. $\frac{1}{2}\left(2I_1 - I_2\right)$

C. $\frac{I_2 - 3I_1}{2}$

D. $\frac{I_2 - I_1}{2}$

Answer: C

Watch Video Solution

7. The first overtone of an open organ pipe beats with the first overtone of a closed organ pipe with a beat frequency $2.2Hz$. The fundamental frequency of the closed organ pipe is $110Hz$, find the lengths of the pipes . Take velocity of sound $= 330m/s$.

A. $I_0 = 3.8937m$

B. $I_0 = 1.9937m$

C. $I_0 = 0.9937m$

D. $I_0 = 2.8937m$

Answer: C

Watch Video Solution

8. A string under a tension of 129.6N produces 10beats/sec when it is vibrated along with a tuning fork. When the tension in the string is increased to 160N, it sounds in unision with the same fork. Calculate the fundamental frequency of the tuning fork.

A. 100 Hz

B. 200 Hz

C. 300 Hz

D. 400 Hz

Answer: A

Watch Video Solution

9. A string $25cm$ long and having a mass of $2.5g$ is under tension. A pipe closed at one end is $40cm$ long . When the string is set vibrating in its first overtone and the air in the pipe in its fundamental frequency, 8 beats per second are heard . It is observed that decreasing the tencion in the string decrease the beat frequency. If the speed of sound in air is $320 m/s$, find the tension in the string.

A. 25.03 N

B. 27.04 N

C. 37.01 N

D. 20.02 N

Answer: B

Watch Video Solution

10. Find the temperature at which the fundamental frequency of an organ pipe is independent of small variation in temperature in terms of the coefficient of linear expansion (α) of the material of the tube.

A. $T_0 = \frac{5}{2\alpha}$

B. $T_0 = \frac{2}{1\alpha}$

C. $T_0 = \frac{3}{2\alpha}$

D. $T_0 = \frac{1}{2\alpha}$

Answer: D

Watch Video Solution

11. Two identical sonometer wires have a fundamental frequency of 400 vibrations per second when kept under the same tension. What fractional increase in the tension of one wire would cause an occurance of 8 beats per second when both wires vibrate together

A. 1%

B. 2%

C. 3%

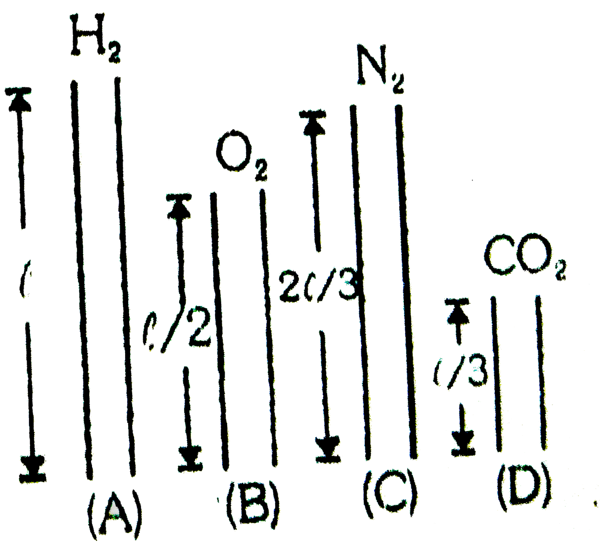
D. 4%

Answer: B

Watch Video Solution

PRACTICE SHEET (EXERCISE -V) (ORGAN PIPES, BEATS) (LEVEL-II ADVANCED) (MORE THAN ONE CORRECT ANSWER TYPE QUESTIONS)

1. Four open organ popes of different length and different gases at same temperature as shown in figure. Let f_A, f_B, f_C and f_D be their fundamental frequencies then : [Take $\gamma_{CO_2} = \frac{4}{3}$]



A. $f_A / f_B = 2$

B. $f_B / f_C = \sqrt{72/28}$

C. $f_C / f_D = \sqrt{\frac{11}{28}}$

D. $f_D / f_A = \sqrt{76/11}$

Answer: A::C

Watch Video Solution

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

A. 0.8 m from the open end

B. 0.4 m from the open end

C. at the closed end

D. 1.0 m from the open end

Answer: B::C

Watch Video Solution

PRACTICE SHEET (EXERCISE -V) (ORGAN PIPES, BEATS) (LEVEL-II ADVANCED) (LINKED COMPREHENSION TYPE QUESTIONS) (PASSAGE -I)

1. The air column in a pipe closed at one end is made to vibrate in its third over tone by tuning fork of frequency 220Hz. The speed of sound in air is 330m/sec. End correction may be neglected. Let P_0 denote the mean pressure at any point in the pipe and ΔP_0 the maximum amplitude of pressure vibration

Find the length of the air column

A. 3.2 m

B. 2.625 m

C. 4.23 m

D. 1.16 m

Answer: B

Watch Video Solution

2. The air column in a pipe closed at one end is made to vibrate in its third over tone by tuning fork of frequency 220Hz. The speed of sound in air is 330m/sec. End correction may be neglected. Let P_0 denote the mean pressure at any point in the pipe and ΔP_0 the maximum amplitude of pressure vibration

Find the length of the air column

A. $\frac{\Delta P_0}{\sqrt{2}}$

B. $\frac{\sqrt{3}\Delta P_0}{2}$

C. ΔP_0

D. $\frac{\Delta P_0}{2}$

Answer: A

Watch Video Solution

3. The air column in a pipe closed at one end is made to vibrate in its third over tone by tuning fork of frequency 220Hz. The speed of sound in air is 330m/sec. End correction may be neglected. Let P_0 denote the mean pressure at any point in the pipe and ΔP_0 the maximum amplitude of pressure vibration

Find the length of the air column

A. P_0

B. $P_0 + \Delta P_0$

C. $P_0 + \frac{P_0}{2}$

D. None of these

Answer: A

Watch Video Solution

PRACTICE SHEET (EXERCISE -V) (ORGAN PIPES, BEATS) (LEVEL-II ADVANCED) (MATRIX MATCHING TYPE QUESTIONS)

1. In closed organ pipe at one end................

Column - I	Column - II
P) Third overtone frequency is x times fundamental frequency then x is	1) 3
Q) Number of nodes in second overtone	2) 4
R) Number of antinodes in second overtone	3) 5
S) nth harmonic does not exists, where n is	4) 7
	5) 6

A. P - 5, Q - 1, R - 1, S - 5

B. P - 4, Q - 1, R - 1, S - 2, 5

C. P - 4, Q - 2, R - 3, S - 2

D. P - 3, Q - 2, R - 4, S - 2, 5

Answer: C

Watch Video Solution

Watch Video Solution

PRACTICE SHEET (EXERCISE -V) (ORGAN PIPES, BEATS) (LEVEL-II ADVANCED) (INTEGER TYPE QUESTIONS)

1. Two identical flutes produce fundamental notes of frequency 300 Hz at $27^{\circ} C$. If the temperature of the air in one of the flutes is increased to $31^{\circ} C$, the number of beats heard per second will be

Watch Video Solution

2. In a standing wave pattern obtained in an open tube filled with Iodine, due to vibrations of frequency 800 cycle/sec the dist between first node, eleventh node is found to be 1 m when the temperature of iodine vapour is $352^{\circ} C$. If the temperature is $127^{\circ} C$, the distance between consecutive nodes is (in centimeters) (approximately).

Watch Video Solution

Watch Video Solution

3. Two sound waves of frequencies $100Hz$ and $102Hz$ and having same amplitude $'A'$ are interfering. At a stationary detector, which can detect resultant amplitude greater than or equal to A. So, in a given time interval of 12 seconds, finds the total duration in which detector is active.

Watch Video Solution

PRACTICE SHEET (EXERCISE -VI) (DOPPLER EFFECT) (LEVEL-I MAIN) (STRAIGHT OBJECTIVE TYPE QUESTIONS)

1. To an observer, the pitch of a stationary source of sound appears to be reduced by 20%. If the speed of sound is 340m/s then speed and direction of the observer is

A. 86 m/s towards the source

B. 68 m/s towards the source

C. 86 m/s away from the source

D. 68 m/s away from the source

Answer: D

Watch Video Solution

2. A Car is travelling at $\frac{v}{10}ms^{-1}$ and sounds horn of frequency 990 Hz. The apparent frequency heard by a police chasing the car at $\frac{v}{9}ms^{-1}$, where V is velocity of sound

A. 990 Hz

B. 900 Hz

C. 1000 Hz

D. 0

Answer: C

Watch Video Solution

3. The wave length of the sound produced by a source is 0.8m. If the source moves towards the stationary listner at $32ms^{-1}$, what is the apparent wave length of sound if the velocity of sound is $320ms^{-1}$

A. 0.32 m

B. 0.4 m from the open end

C. 0.72 m

D. 0.80 m

Answer: C

Watch Video Solution

4. A motor cycle starts from rest and accelerates along a straight path at $2m/s^2$. At the straight point of the motor cycle there is a stationary electric siren. How far has the motor cycle gone when the driver hears the frequency of the siren at 94% of its value when the motor cycle was at rest? (Speed of sound = 330 ms^{-1})

A. 98 m

B. 147 m

C. 196 m

D. 49 m

Answer: A

Watch Video Solution

5. The wavelength of H_α line in hydrogen spectrum was found 6563Å in the laboratory. If the wavelength of same line in the spectrum of a milky way is observed to be 6586Å, then the recessional velocity of the milky way will be

A. $0.105 \times 10^6 ms^{-1}$

B. $1.05 \times 10^6 ms^{-1}$

C. $10.5 ms^{-1}$

D. none of these

Answer: B

Watch Video Solution

6. A vehicle sounding a whistle of frequency 256 Hz is moving on a straight road, towards a hill with a velocity of 10 m/s. The number of beats produced per second is (Velocity of sound = 330 m/s)

A. Zero

B. 10

C. 14

D. 16

Answer: D

Watch Video Solution

7. A source of sound and an observer are approaching each other with the same speed, which is equal to $\left(\frac{1}{10}\right)$ times the speed of sound. The apparent relative change in frequency of source is

A. 22.2% increases

B. 22.2 % decreases

C. 18.2 % decreases

D. 18.2 % increases

Answer: A

Watch Video Solution

8. A police car moving at 22 m/s chases a motorcyclist. The police man sounds his horn at 176 Hz, while both of them move towards a stationary siren of frequency 165 Hz. Calculate the speed of the motorcycle. If it is given that the motorcyclist does not observe any beats (Velocity of sound = 330 m/s)

A. 33 m/s

B. 22 m/s

C. zero

D. 11 m/s

Answer: B

Watch Video Solution

9. Earth is moving towards a stationary star with a velocity $100kms^{-1}$. If the wavelength of light emitted by the star is 5000Å, then the apparent change in wavelength observed by the observer on earth will be

A. 0.67 A^0

B. $1.67A^0$

C. $16.7A^0$

D. $167A^0$

Answer: B

Watch Video Solution

10. A radar sends a radio signal of frequency $9 \times 10^3 Hz$ towards an aircraft approaching the radar. If the reflected wave shows a frequency shift of $3 \times 10^3 Hz$ the speed with which the aircraft is approaching the radar in ms-1 (velocity of the rador signal is $3 \times 10^8 ms^{-1}$)

A. 150

B. 100

C. 50

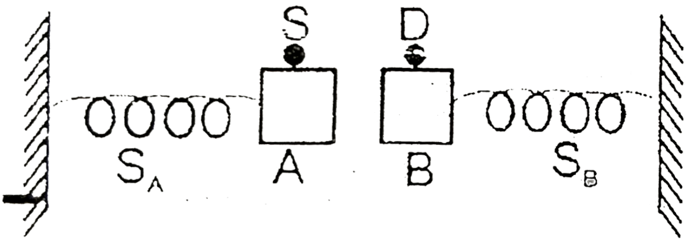
D. 25

Answer: C

Watch Video Solution

PRACTICE SHEET (EXERCISE -VI) (DOPPLER EFFECT) (LEVEL-II ADVANCED) (STRAIGHT OBJECTIVE TYPE QUESTIONS)

1. A source S emitting sound of $300Hz$ is fixed on block A which is attache to free end of a spring S_A as shown in figure. The detector D fixed on block B attached to free end of spring S_B detects this sound. The blocks A and B simultaneously displaced towards each other thrugh a distance of $2.0m$ and then left to vibrate. If the product of maximum and minimum freuquencies of sound detected by D is $K + 10^4 \sec^{-2}$. Find K. Given the vibrational frequencies of each block is $5/\pi Hz$. speed of sound in air $= 300m/s$



A. 323 Hz, 278.6 Hz

B. 276.8 Hz, 330 Hz

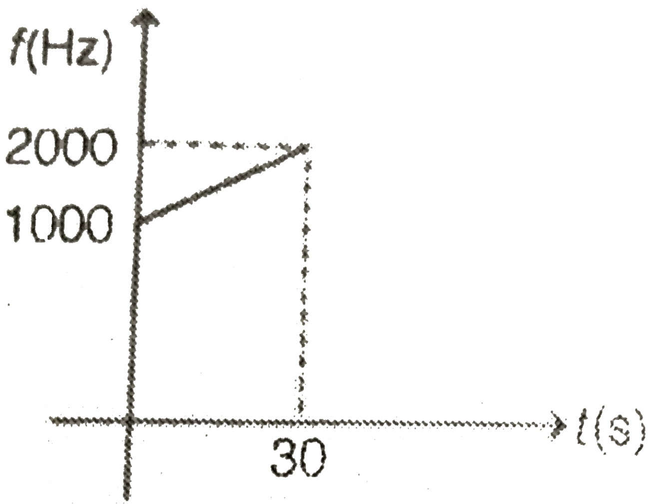
C. 260 Hz , 241 Hz

D. 340 Hz , 260 Hz

Answer: A

Watch Video Solution

2. 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 $\left(g = 10m/s^2\right)$



A. 330 m/s

B. 350 m/s

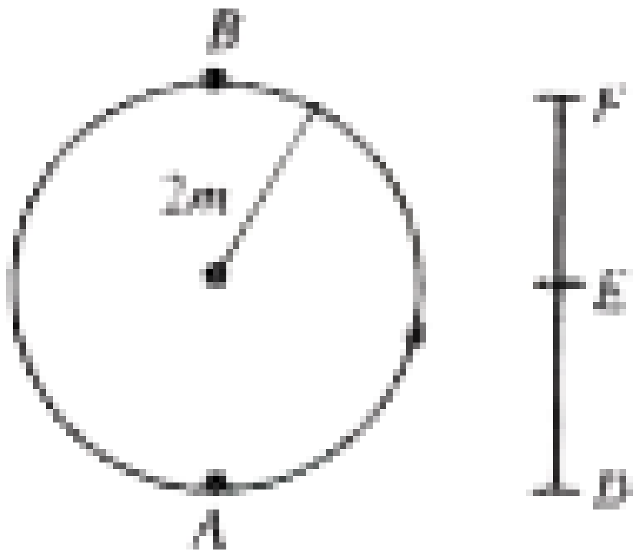
C. 300 m/s

D. 310 m/s

Answer: C

Watch Video Solution

3. A source of sound emitting a frequency 660 Hz is moving counter-clockwise in a circular path of radius 2 metres with an angular velocity 15 rad/s. A recorder at a distance from the source is moving simple harmonically along a straight line with an amplitude 2 metres. The frequency of SHM is $\frac{15}{2\pi}$ per second. The arrangement is shown in figure. When the source is at point A the detector is at D. Find the maximum and minimum frequencies recorded. Velocity of sound in air at this temperature can be taken as 300 m/s



A. 870 Hz, 480 Hz

B. 733.4 Hz, 600 Hz

C. 680 Hz, 380 Hz

D. 580 Hz, 280 Hz

Answer: B

Watch Video Solution

4. When source and detector are stationary but the wind is blowing at speed v_W, the apparent wavelength λ' on the wind side is related to actual wavelength λ by [take speed of sound is air as v]

A. $\lambda^1 = \lambda$

B. $\lambda^1 = \frac{V_w}{V}\lambda$

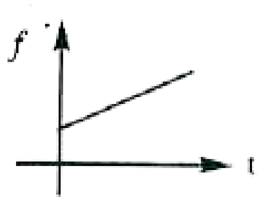
C. $\lambda^1 = \left(V_W + V\right)\frac{\lambda}{V}$

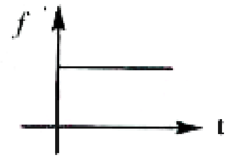
D. $\lambda^1 = \left(\frac{V}{V - V_W}\right)\lambda$

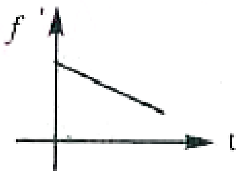
Answer: C

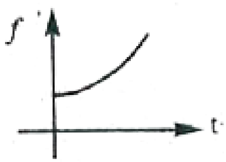
Watch Video Solution

5. An observer starts moving with uniform acceleration a' towards in stationary sound source of frequency f. 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

Watch Video Solution

6. A sounding body of negligible dimension emiting a frequency of 150 Hz is dropped from a height. During its fall under gravity it passes near a ballon moving up with a constant velocity of 2 m/s . One second after is started to fall , the difference in the frequency observed by the man in ballon just before and just after crossing the body will be (given that velocity of sound = 300 m/s , g = $10m/s^2$)

A. 12

B. 6

C. 8

D. 4

Answer: A

Watch Video Solution

7. When the medium moves and the source and observer are stationary:

A. λ changes

B. λ remains constant

C. frequency changes

D. none of these

Answer: A

Watch Video Solution

8. A source of sound attached to the bob of a simple pendulum execute SHM . The difference between the apparent frequency of sound as received by an observer during its approach and recession at the mean frequency of the source . The velocity of the source at the mean position is (velocity of sound in the air is $340 m/s$)

[Assume velocity of sound $< <$ velocity of sound in air]

A. 1.4 m/s

B. 3.4 m/s

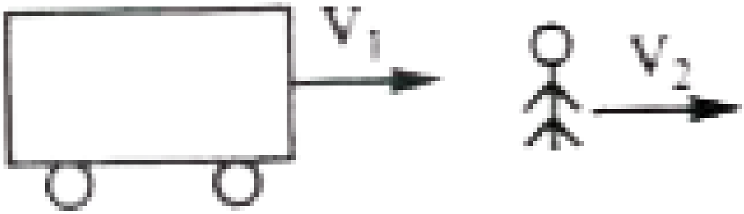
C. 1.7 m/s

D. 2.1 m/s

Answer: B

Watch Video Solution

9. A car moving with a velocity v_1 overtakes a person moving with a velocity v_2 . The ratio of frequencies of sound Just before and after overtaking, is:



A. $\left(c - v_1\right)\dfrac{c - v_2}{\left(c + v_1\right)\left(c + v_2\right)}$

B. $\dfrac{\left(c + v_2\right)\left(c - v_2\right)}{\left(c - v_1\right)\left(c + v_1\right)}$

C. $\dfrac{\left(c + v_1\right)\left(c + v_2\right)}{\left(c - v_1\right)\left(c - v_1\right)}$

D. $\dfrac{\left(c - v_1\right)\left(c + v_2\right)}{c + v_1}\left(c - v_2\right)$

Answer: B

Watch Video Solution

PRACTICE SHEET (EXERCISE -VI) (DOPPLER EFFECT) (LEVEL-II ADVANCED) (MORE THAN ONE CORRECT ANSWER TYPE QUESTIONS)

1. Consider a source of sound S, and an observer P. The source emits sound of frequency N_0. The frequency observed by P is found to be N_1 if P approaches S at a speed v and S is stationary; N_2 if S approaches P at a speed v and P is stationary and N_3 if each of P and S has speed v/2 towards one another

A. $n_1 = n_2 = n_3$

B. $n_1 < n_2$

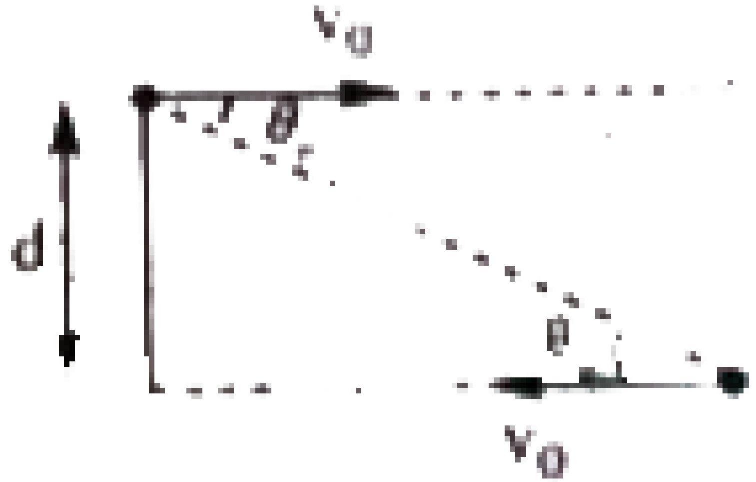
C. $n_3 > n_0$

D. n_3 lies between n_1 and n_2

Answer: B::C::D

Watch Video Solution

2. A source of sound emitting a sound of frequency f_0 and detector are moving with same speed v_0 as shown in the figure at t = 0. Take velocity of sound wave to be v (>> v_0).



For this situation mark out the correct statement(s)

A. The frequency received by the detector is always greater than f_0

B. Initially, frequency received by the detector is greater than f_0, becomes equal to f_0, and then decreases with the time.

C. Frequency received by the detector is equal to f_0 at $t = d\cot\theta_0 / (2v_0)$

D. Frequency received by the detector can never be equal to f_0

Answer: B::C

Watch Video Solution

3. Choose the correct option (S)?

A. When a source of sound move towards a stationary observer the wavelength of the sound as heard by the observer is less than the original wavelength of the source.

B. When both observer and the source, of sound moves towards each other, the wave length of the sound as heard by the observer is less than the wavelength of the original sound.

C. When both observer and the source of sound moves away from each other, the wavelength of the sound as heard by the observer is less than the wavelength of the original sound.

D. When an observer moves away from a stationary source, the wavelength of the sound heard by the observer is less than the wavelength of the original sound.

Answer: A::B::C

Watch Video Solution

4. A source 'S' emitting a sound of frequency 300 Hz is fixed on block ‘A’ while detector is fixed on block 'B' detects the sound. The block 'A' and 'B' are simultaneously displaced towards each other through a distance of 1 m and then left to vibrate. If the velocity of sound in air is $340ms^{-1}$ and S_A, S_B are identical the frequency of block A is 2Hz. Then

A. Maximum velocity of detector is $4\pi ms^{-1}$

B. Maximum frequency detected by detector is 323 Hz (approximately)

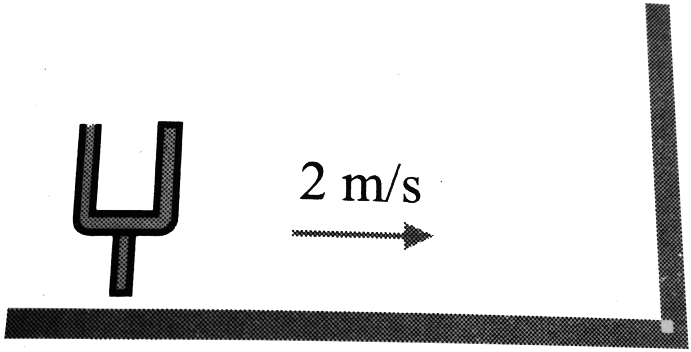
C. Minimum frequency detected by detector is 278 Hz (approximately)

D. The phase difference between S and D is $\frac{\pi}{4}$

Answer: A::B::C

Watch Video Solution

PRACTICE SHEET (EXERCISE -VI) (DOPPLER EFFECT) (LEVEL-II ADVANCED) (LINKED COMPREHENSION TYPE QUESTIONS) (PASSAGE -I)



1.

As shown if Fig. a vibrating tuning fork of frequency 512 Hz is moving towards the wall with a speed $2\frac{m}{s}$. Take speed of sound as $v = 340\frac{m}{s}$ and answer the following questions.

Q. Suppose that a listener is located at rest between the tuning fork and the wall. Number of beats heard by the listener per second will be

A. 4

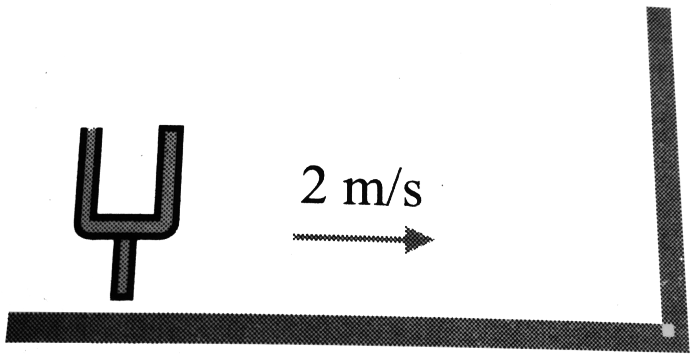
B. 3

C. 0

D. 1

Answer: C

Watch Video Solution



2.

As shown if Fig. a vibrating tuning fork of frequency 512 Hz is moving towards the wall with a speed $2\frac{m}{s}$. Take speed of sound as $v = 340\frac{m}{s}$ and answer the following questions.

Q. If the listener, along with the source, is moving towards the wall with the same speed i.e., $2\frac{m}{s}$, such that the source remains between the listerner and the wall, number of beats heard by the listerner per second will be

A. 3

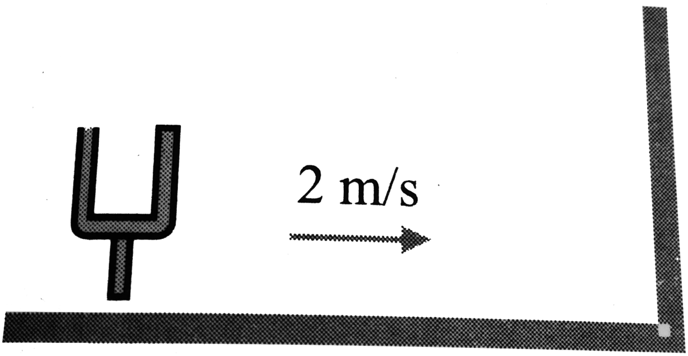
B. 8

C. 0

D. 6

Answer: D

Watch Video Solution



3.

As shown if Fig. a vibrating tuning fork of frequency 512 Hz is moving towards the wall with a speed $2\frac{m}{s}$. Take speed of sound as $v = 340\frac{m}{s}$

and answer the following questions.

Q. If the listerner along with the source is moving towards the wall with the same speed i.e., $2\frac{m}{s}$, such that he (listener) remains between the source and the wall, number of beats heard by him will be

A. 2

B. 6

C. 8

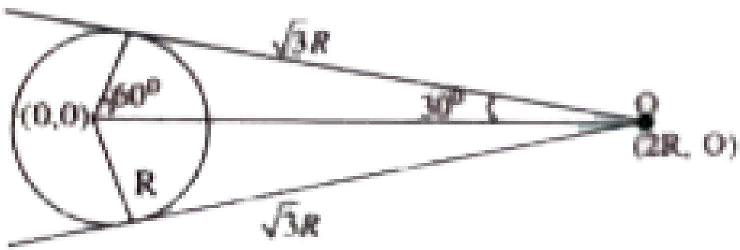
D. 4

Answer: B

Watch Video Solution

PRACTICE SHEET (EXERCISE -VI) (DOPPLER EFFECT) (LEVEL-II ADVANCED) (LINKED COMPREHENSION TYPE QUESTIONS) (PASSAGE -II)

1. A source is moving along a circle $X^2 + Y^2 = R^2$ with constant speed $V_s = \frac{330\pi}{6\sqrt{3}}$ m/s in clockwise direction while on observer is stationary at point (2R,0) with respect to the centre of circle frequency emitted by the source is f [velocity of sound V= 330 m/s]



Maximum frequency heard by observer

A. $\left(\frac{R}{2}, \frac{R}{2}\right)\left(\frac{R}{2}, -\frac{R}{2}\right)$

B. $\left(\frac{R}{2}, \frac{\sqrt{3}R}{2}\right)\left(\frac{R}{2}, -\frac{\sqrt{3}R}{2}\right)$

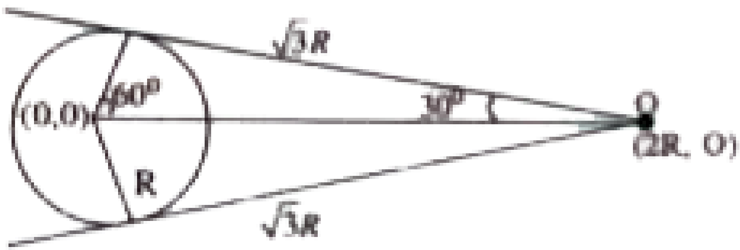
C. $\left(\frac{\sqrt{3}R}{2}, \frac{\sqrt{3}R}{2}\right)\left(\frac{\sqrt{3}R}{2}, -\frac{\sqrt{3}}{2}\right)$

D. $\left(\frac{\sqrt{3}R}{2}, \frac{R}{2}\right)(0, -R)$

Answer: D

Watch Video Solution

2. A source is moving along a circle $X^2 + Y^2 = R^2$ with constant speed $V_s = \frac{330\pi}{6\sqrt{3}}$ m/s in clockwise direction while on observer is stationary at point (2R,0) with respect to the centre of circle frequency emitted by the source is f [velocity of sound V= 330 m/s]



Maximum frequency heard by observer

A. $\left[\frac{\sqrt{3}}{\sqrt{3} - \pi}\right]f$

B. $\left[\frac{6\sqrt{3}}{6\sqrt{3} - \pi}\right]f$

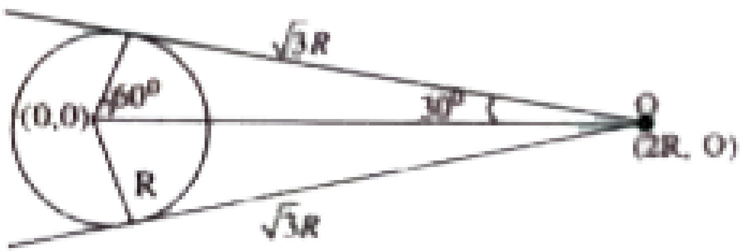
C. $\left[\frac{6}{6 - \pi}\right]f$

D. $\left[\frac{6\sqrt{3}}{6 - \pi}\right]f$

Answer: B

Watch Video Solution

3. A source is moving along a circle $X^2 + Y^2 = R^2$ with constant speed $V_s = \frac{330\pi}{6\sqrt{3}}$ m/s in clockwise direction while on observer is stationary at point (2R,0) with respect to the centre of circle frequency emitted by the source is f [velocity of sound V= 330 m/s]



Maximum frequency heard by observer

A. $\left(\sqrt{3} + n\pi\right)\frac{V}{f}$

B. $\frac{6+\pi}{6}\frac{V}{f}$

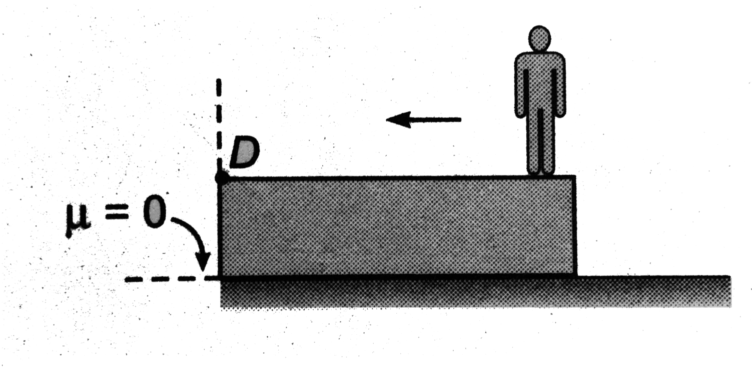
C. $\frac{6\sqrt{3}-\pi}{6\sqrt{3}}\frac{V}{f}$

D. $\left(\frac{6\sqrt{3}+\pi}{6\sqrt{3}}\right)\frac{V}{f}$

Answer: D

Watch Video Solution

4. A man of mass $50kg$ is runing on a plank of mass $150kg$ with speed of $8m/s$ relative to plank as shows in the figure (both were initially at rest and velocity of man with respect to ground any how remains constant). Plank is placed on smooth horizontal surface. The man, while running, whistle with frequency f_o. A detected (D) placed on plank detects frequency. The man jumps off with same velocity (w.r.t. to ground) from point D and slides on the smooth horizontal surface [Assume coefficient of friction between man and horizontal is zero]. The speed of sound in still medium is $330m/s$. Answer the following questions on the basis of above situations.



The frequency of sound detected by detector D, before man jumps of the plank is

A. $\frac{332}{324}f_0$

B. $\frac{330}{322}f_0$

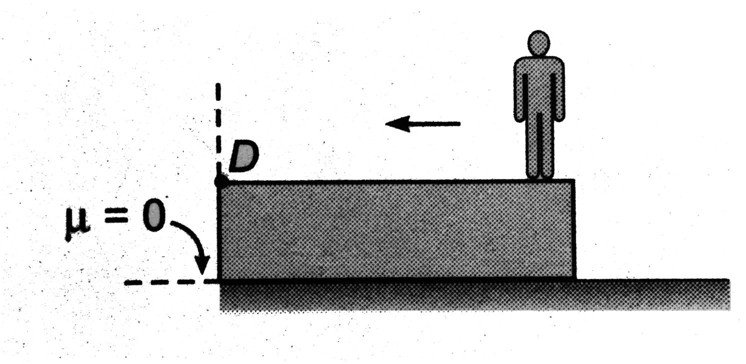
C. $\frac{328}{336}f_0$

D. $\frac{328}{338}f_0$

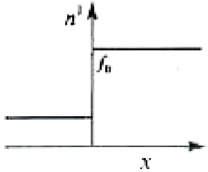
Answer: C

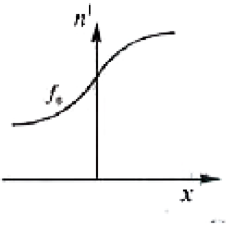
Watch Video Solution

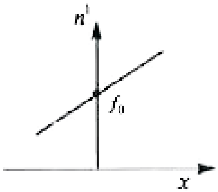
5. A man of mass $50kg$ is runing on a plank of mass $150kg$ with speed of $8m/s$ relative to plank as shows in the figure (both were initially at rest and velocity of man with respect to ground any how remains constant). Plank is placed on smooth horizontal surface. The man, while running, whistle with frequency f_o. A detected (D) placed on plank detects frequency. The man jumps off with same velocity (w.r.t. to ground) from point D and slides on the smooth horizontal surface [Assume coefficient of friction between man and horizontal is zero]. The speed of sound in still medium is $330m/s$. Answer the following questions on the basis of above situations.

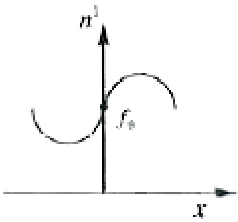


The frequency of sound detected by detector D, before man jumps of the plank is

A. 

B. 

C. 

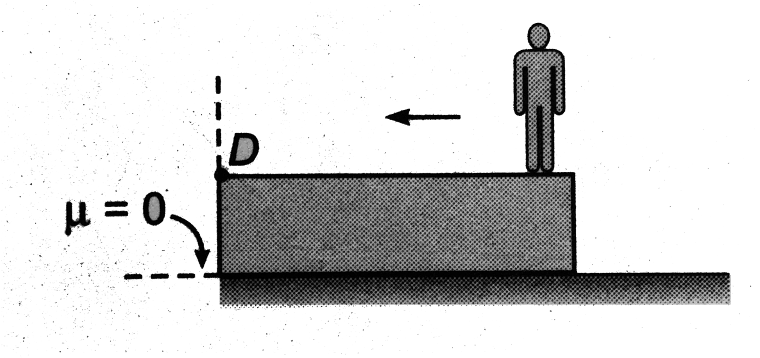
D. 

Answer: A

Watch Video Solution

PRACTICE SHEET (EXERCISE -VI) (DOPPLER EFFECT) (LEVEL-II ADVANCED) (LINKED COMPREHENSION TYPE QUESTIONS) (PASSAGE -III)

1. A man of mass $50kg$ is runing on a plank of mass $150kg$ with speed of $8m/s$ relative to plank as shows in the figure (both were initially at rest and velocity of man with respect to ground any how remains constant). Plank is placed on smooth horizontal surface. The man, while running, whistle with frequency f_o. A detected (D) placed on plank detects frequency. The man jumps off with same velocity (w.r.t. to ground) from point D and slides on the smooth horizontal surface [Assume coefficient of friction between man and horizontal is zero]. The speed of sound in still medium is $330m/s$. Answer the following questions on the basis of above situations.



The frequency of sound detected by detector D, before man jumps of the plank is

A. $\frac{332}{324}f_0$

B. $\frac{330}{322}f_0$

C. $\frac{328}{336}f_0$

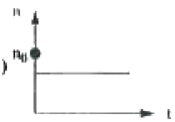
D. $\frac{328}{338}f_0$

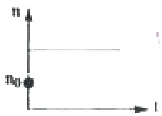
Answer: A

Watch Video Solution

1. The following figures in the Column-II indicate the direction of motion of source and the observer match the corresponding graph in Column-I drawn between the apparent frequency. and time V_0 is the velocity of observer V_s the velocity of source, and n_0 the frequency of the source

Column - I

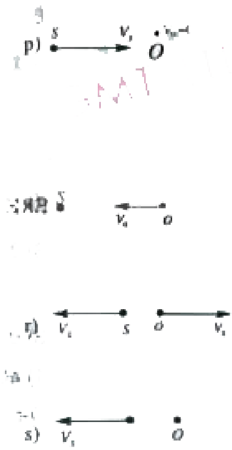
A) 

B) 

C) $\lambda = \frac{V}{n_0}$

D) $\lambda \neq \frac{V}{n_0}$

Column - II



Watch Video Solution

PRACTICE SHEET (EXERCISE -VI) (DOPPLER EFFECT) (LEVEL-II ADVANCED) (INTEGER TYPE QUESTIONS)

1. Two trains are moving towards each other at speed of 144 km/hr and 54 km/hr relative to the ground. The second sounds a whistle of frequency 710 Hz, the frequency of this whistle as heard by a passenger in the first train after the trains have crossed each other is $x \times 10^2 Hz$, what is value of x. (v = 340 m/s)

Watch Video Solution

2. A car with a horn of frequency 620 Hz travels towards a large wall at a speed of $20ms^{-1}$ the frequency of echo of sound as heard by the driver is $x \times 10^2 Hz$, what is the value of x (velocity of sound -330m/s

Watch Video Solution

3. One train is approaching an observer at rest and another train is receding him with same velocity $4ms^{-1}$. Both the trains blow whistles of same frequency of 243 Hz. The beat frequency in Hz as heard by the observer is (speed of sound in air=$320ms^{-1}$)

Watch Video Solution

4. The frequency of a source of sound as measured by an observer when the source is moving towards him with a speed of 30 m/s is 720 Hz. The apparent frequency when the source is moving away after crossing the observer is $x \times 10^2 Hz$ what is the value of x. .... (velocity of sound is 330 m/s)

Watch Video Solution

ADDITIONAL PRACTICE EXERCISE (LEVEL -I MAIN) (STRAIGHT OBJECTIVE TYPE QUESTIONS)

1. The intensity of a sound wave gets reduced by 20% on passing through a slab. The reduction intensity on passage through two such consecutive slabs

A. 40%

B. 36%

C. 30%

D. 50%

Answer: B

Watch Video Solution

2. A string of length l is stretched by 1/30 and transverse waves in the string are found to travel at a speed v_0. Speed of transverse waves when the string is stretched by 1/15 will be :

A. $\frac{v_0}{2}$

B. $2v_0$

C. $2\sqrt{2}v_0$

D. $\sqrt{2}v_0$

Answer: D

Watch Video Solution

3. The speed of a wave on a string is 150 m/s when the tension is 120 N . The percentage increase in the tension in order to raise the wave speed by 20% is

A. 44 %

B. 40 %

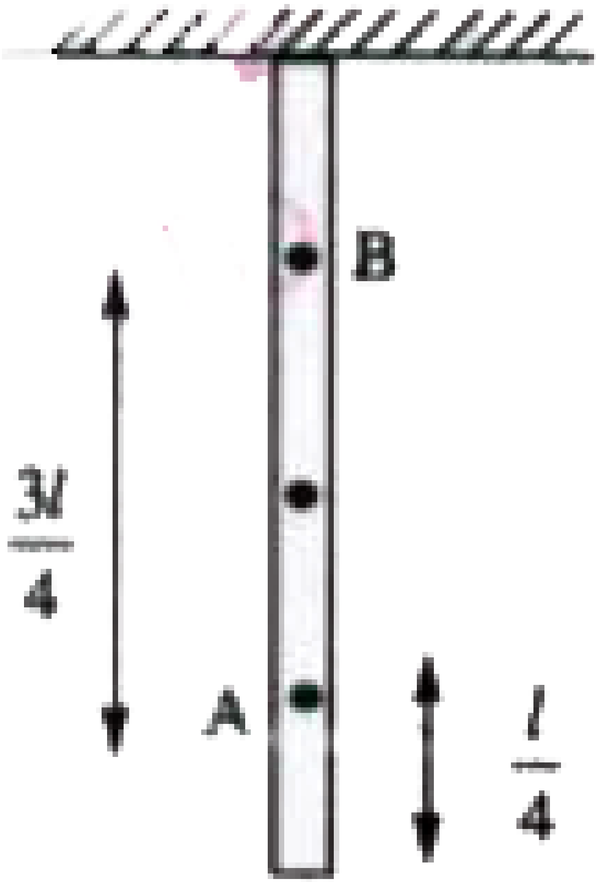
C. 20 %

D. $10\ \%$

Answer: A

Watch Video Solution

4. A string of mass m and length l is hanging from ceiling as shown in the Fig. Wave in string move upward. $v_A$and v_B are the speed of wave at A and B respectively. Then $v_B$is :



A. $\sqrt{3}v_A$

B. v_A

C. $< v_A$

D. $\sqrt{2}v_A$

Answer: A

Watch Video Solution

5. Two vibrating tunign forks produce progessive waves given by

$y_1 = 4\sin 500\pi t$ and $y_2 2\sin 506\pi t$.

Number of beat produced pre minture is .

A. 3 beats/s with intensity ratio between maxima and minima equal to 2

B. 3 beats/s with intensity ratio between maxima and minima equal to 9

C. 6 beats/s with intensity ratio between maxima and minima equal to 2

D. 6 beats/s with intensity ratio between maxima and minima equal to 9

Answer: B

Watch Video Solution

6. two waves of wavelengths 2 m and 2.02 m respectively, moving with the same velocity superpose to produce 2 beats per second. The velocity of the wave is

A. 400.0 m/s

B. 402.0 m/s

C. 404.0 m/s

D. 406.0 m/s

Answer: C

Watch Video Solution

7. A glass tube of $1.0m$ length is filled with water . The water can be drained out slowly at the bottom of the tube . If a vibrating tuning fork of frequency $500c/s$ is brought at the upper end of the tube and the velocity of sound is $330m/s$, then the total number of resonances obtained will be

A. 4

B. 3

C. 2

D. 1

Answer: B

Watch Video Solution

8. An object producing a pitch of 100 h=Hz approaches a stationary person in a straight line with a velocity of 200 m/s. Velocity of sound is 300 m/s. The person will note a change in frequency, as the object flies past him equal to

A. 1440 Hz

B. 240 Hz

C. 1200 Hz

D. 960 Hz

Answer: D

Watch Video Solution

9. In an experiment it was found that a sonometer in its fundamental mode of vibration and a tuning fork gave 5 beats when length of wire is 1.05 metre or 1 metre. The velocity of tranverse waves in sonometer wire when its length is 1m

A. 400 m/s

B. 210 m/s

C. 420 m/s

D. 450 m/s

Answer: C

Watch Video Solution

10. A person with vibrating tuning fork of frequency 338 Hz is moving towards a vertical wall with speed of $2ms^{-1}$ Velocity of sound in air is $340ms^{-1}$ The number of beats heard per second is

A. 2

B. 4

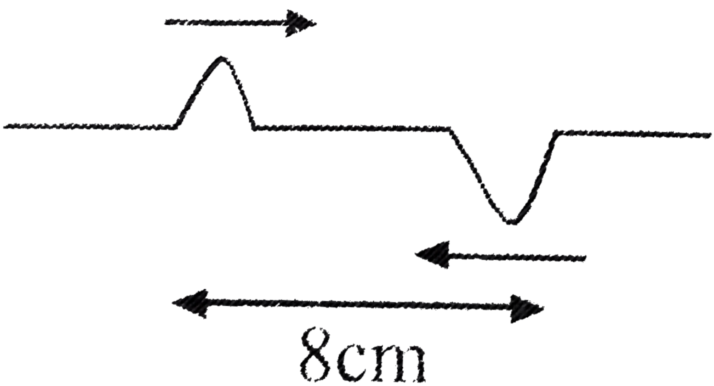
C. 6

D. 8

Answer: B

Watch Video Solution

11. Two pulses in a stretched string whose centres are initially 8 cm apart are moving towards each other as shown in the figure. The speed of each pulse is 2 cm/s. After 2 second, the total energy of the pulses will be



A. zero

B. purely kinetic

C. purely potential

D. partly kinetic and partly potential

Answer: B

Watch Video Solution

12. 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 tnterference betwenn successive pulses is

A. 0.05 s

B. 0.10 s

C. 0.20 s

D. 0.40 s

Answer: B

Watch Video Solution

Watch Video Solution

13. The extension in a string obeying Hooke's law is x. The speed of transverse wave in the stretched string is v. If the extension in the string is increased to 1.5x, the speed of transverse wave will be

A. 1.22 v

B. 0.61 v

C. 1.50 v

D. 0.75 v

Answer: A

Watch Video Solution

14. The displacement of a particle in a periodic motion is given by $y = 4\cos^2(t/2)\sin(1000t)$. This displacement may be considered as the result superposition of n independent harmonic oscillations. Here , n is

A. two

B. three

C. four

D. five

Answer: B

Watch Video Solution

ADDITIONAL PRACTICE EXERCISE (LEVEL -II)(LECTURE SHEET ADVANCED) (MORE THAN ONE CORRECT ANSWER TYPE QUESTIONS)

1. $y(x, t) = 0.8/\left[(4x + 5t)^2 + 5\right]$ represent a moving pulse, where x and y are in metres and t is in seconds, then

A. pulse is moving in $+x$ -direction

B. ih 2 seconds it will travel a distance of 2.5 m

C. its maximum displacement is 0.16 m

D. it is symmetric pulse

Answer: B::C

Watch Video Solution

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

A. electric field

B. magnetic field

C. displacement

D. pressure

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

Watch Video Solution

3. As a wave propagates

A. the wave intensity remains constant for a plane wave

B. the wave intensity decreases as the inverse of the distance from the source for a spherical Wave

C. the wave intensity decreases as the inverse square of the distance from the source for a spherical wave

D. total intensity of the spherical wave over the spherical surface centred at the source remains constant at all times

Answer: A::C::D

Watch Video Solution

ADDITIONAL PRACTICE EXERCISE (LEVEL -II)(LECTURE SHEET ADVANCED) (MATRIX MATCHING TYPE QUESTIONS)

1. Let is consider the following diagram in which a block of mass M is being supported by a uniform rope of mass 1 kg and length 10 metre, a pulse is created at the bottom of the rope and it reaches the top. In column I the value of M in kg is given and in column II time (in sec) after which the pulse reaches the top is given. Match them

Column - I	Column - II
A) 1	p) $2(2-\sqrt{3})$
B) 2	q) $2(\sqrt{5}-2)$
C) 3	r) $2(2+\sqrt{3})$
D) 4	s) $2(\sqrt{2}-1)$

Watch Video Solution

2. Consider a situation (i) that two sound waves, $y_1 = (0.2m)\sin 504\pi(t - x/300)$ and $y_2 = (0.6m)\sin 496\pi(t - x/300)$, are superimposed. Consider another situation (ii) that two sound waves, $y'_1 = (0.4m)\sin 504\pi(t - x/300)$ and $y'_2 = (0.4m)\sin 504\pi(t + x/300)$, are superimposed.

Match the Column-I and Column-II

Column-I	Column-II
(A) In situation (i)	(p) Stationary waves are formed
(B) In situation (ii)	(q) There will be the phenomenon of 'Beats'
(C) When two waves of same frequency and amplitude and travelling in opposite directions superimpose	(r) Amplitude of the resultant wave will vary periodically with position
(D) If the intensity of sound alternately increases and decreases periodically as a result of superposition of waves of slightly different frequency	(s) Amplitude of the resultant wave will vary periodically
	(t) Amplitude of the resultant wave is constant

Watch Video Solution

ADDITIONAL PRACTICE EXERCISE (LEVEL -II)(LECTURE SHEET ADVANCED) (LINKED COMPREHENSION TYPE QUESTIONS) (PASSAGE-I)

1. A child playing with a long rope ties one end holds the other. The rope is stretched taut along the horizontal. The child shakes the end he is holding, up and down, in a sinusoidal manner with amplitude

$10cm$ and frequency 3 Hz.

Speed of the wave is $15m/s$ and, at $t = 0$, displacement at the child's end is maximum positive. Assuming that there is no wave reflected from the fixed end, so that the waves in the rope are plane progressive waves, answer the following quetions.

(Also assume that the wave propagates along the positive x - direction.)

A wave function that describe the wave in the given sutuation is

A. y = (0.1m) cos[(2 rad / m) x - (12.5 rad / s) t]

B. y = (0.1m) cos[(1.26 rad / m) x - (18.8 rad / s) t]

C. y = (0.1m) sin[(1.5 rad / m) x - (10 rad / s) t]

D. y = (0.1m) sin[(2 rad / m) x - (4 rad / s) t]

Answer: B

Watch Video Solution

2. A child playing with a long rope ties one end holds the other. The rope is stretched taut along the horizontal. The child shakes the end he is holding, up and down, in a sinusoidal manner with amplitude $10cm$ and frequency 3 Hz.

Speed of the wave is $15m/s$ and, at $t = 0$, displacement at the child's end is maximum positive. Assuming that there is no wave reflected from the fixed end, so that the waves in the rope are plane progressive waves, answer the following quetions.

(Also assume that the wave propagates along the positive x-direction.)

Phase difference between the child,s end and a point $2.5m$ from the child's end will be

A. y = -(0.1 m) cos (18.8 rad / s) t

B. y = (0.1 m) cos (12.5 rad / s) t

C. y = (0.1 m) sin (4 rad / s) t

D. y = -(0.1 m) sin (10 rad / s) t

Answer: A

Watch Video Solution

3. A child playing with a long rope ties one end holds the other. The rope is stretched taut along the horizontal. The child shakes the end he is holding, up and down, in a sinusoidal manner with amplitude $10cm$ and frequency 3 Hz.

Speed of the wave is $15m/s$ and, at $t=0$, displacement at the child's end is maximum positive. Assuming that there is no wave reflected from the fixed end, so that the waves in the rope are plane progressive waves, answer the following quetions.

(Also assume that the wave propagates along the positive x-direction.)

Phase difference between the child,s end and a point $2.5m$ from the child's end will be

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

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

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

D. π

Answer: D

Watch Video Solution

4. A child playing with a long rope ties one end holds the other. The rope is stretched taut along the horizontal. The child shakes the end he is holding, up and down, in a sinusoidal manner with amplitude $10cm$ and frequency 3 Hz.

Speed of the wave is $15m/s$ and, at $t = 0$, displacement at the child's end is maximum positive. Assuming that there is no wave reflected from the fixed end, so that the waves in the rope are plane progressive waves, answer the following quetions.

(Also assume that the wave propagates along the positive x-direction.)

Phase difference between the child,s end and a point $2.5m$ from the child's end will be

A. 3 m/s

B. 4.5 m/s

C. zero

D. 12.5 m/s

Answer: C

Watch Video Solution

ADDITIONAL PRACTICE EXERCISE (LEVEL -II)(LECTURE SHEET ADVANCED) (LINKED COMPREHENSION TYPE QUESTIONS) (PASSAGE-II)

1. One end of a long rope is tied to a fixed vertical pole. The rope is stretched horizontally with a tension 8 N. Let us consider the length of the rope to be along X-axis. A sample harmonic oscillator at x = 0 generates a transverse wave of frequency 100 Hz and amplitude 2 cm along the rope. Mass of a unit length of the rope is 20 gm/m. Ignoring the effect of gravity, answer the following questions

Wavelength of the wave is

A. 50 cm

B. 20 cm

C. 8 cm

D. 32 cm

Answer: B

Watch Video Solution

2. One end of a long rope is tied to a fixed vertical pole. The rope is stretched horizontally with a tension 8 N. Let us consider the length of the rope to be along X-axis. A sample harmonic oscillator at x = 0 generates a transverse wave of frequency 100 Hz and amplitude 2 cm along the rope. Mass of a unit length of the rope is 20 gm/m. Ignoring the effect of gravity, answer the following questions

Wavelength of the wave is

A. The wave propagates with a fixed and any particle of the medium vibrates with the same fixed speed

B. The wave propagates with a fixed speed but any particle of the medium vibrates with a variable speed

C. The wave propagates with a variable speed but arty particle of the medium vibrates with some fixed speed

D. The wave propagates with a variable speed and arty particle of the medium also vibrates with a variable speed

Answer: B

Watch Video Solution

3. One end of a long rope is tied to a fixed vertical pole. The rope is stretched horizontally with a tension 8 N. Let us consider the length of the rope to be along X-axis. A sample harmonic oscillator at x = 0 generates a transverse wave of frequency 100 Hz and amplitude 2 cm along the rope. Mass of a unit length of the rope is 20 gm/m. Ignoring the effect of gravity, answer the following questions

Maximum magnitude of transverse acceleration of any point on the rope will be nearly

A. $7888 m/s^2$

B. $8244 m/s^2$

C. $9277 m/s^2$

D. $3333 m/s^2$

Answer: A

Watch Video Solution

ADDITIONAL PRACTICE EXERCISE (LEVEL -II)(LECTURE SHEET ADVANCED) (INTEGER TYPE QUESTIONS)

1. 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?

Watch Video Solution

2. In a sonometer wire, the tension is maintained by suspending a 50.7 kg mass from the free end of the wire. The suspended mass has a volume of $0.0075m^3$. The fundamental frequency of vibration of the wire is 260 Hz. If the suspended mass is completely submerged in water, the fundamental frequency will become ________ Hz.

Watch Video Solution

3. A string with tension T and mass per unit length μ is clamped down at x=0 and at x=L. at t=0, the string is at rest and displaced in the y-direction

$$y(x,0) = 2\sin\frac{2\pi x}{L} + 2\sin\frac{\pi x}{L}$$

Q. The string is released at t=0, and it starts to oscillate. the displacement of string at time t is

Watch Video Solution

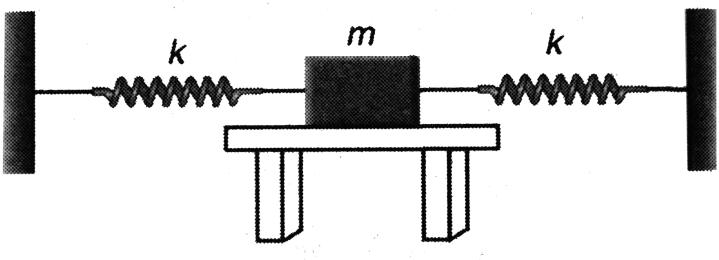
4. A gas is a mixture of two parts by volume of hyprogen and part by volume of nitrogen at STP. If the velocity of sound in hydrogen at $0\,^{\circ}C$ is $1300 m/s$. Find the velocity of sound in the gaseous mixure at $27\,^{\circ}C$.

Watch Video Solution

5. A uniform rope of mass of 0.1 kg and length 2.45 m hangs from the ceiling. The time taken by a transverse wave to travel the full length of rope is n sec. Then n

Watch Video Solution

6. 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.



Watch Video Solution

ADDITIONAL PRACTICE EXERCISE PRACTICE SHEET (ADVANCED) (MORE THAN ONE CORRECT ANSWER TYPE QUESTIONS)

1. In case of superposition of waves (at x = 0). $y_1 = 4\sin(1026\pi t)$ and $y_2 = 2\sin(1014\pi t)$

A. the frequency of resulting wave is 510 Hz

B. the amplitude of resulting wave varies of frequency 3 Hz

C. the frequency of beats is 6 Hz

D. the ratio of maximum to minimum intensity is 9

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

Watch Video Solution

2. The vibrations of a string of length 60 cm fixed at both ends are represented by the equation $y = 4\sin\left(\frac{\pi x}{15}\right)\cos(96\pi t)$, where x and y are in cm and t in seconds.

(a)What is the maximum displacement of a point at $x = 5cm$?

(b)Where are the nodes located along the string?

(c)What is the velocity of the particle at x=7.5cm and t=0.25s?

(d)Write down the equations of the component waves whose superposition gives the above wave.

A. maximum displacement of a particle at a point at x = t cm is 4 cm

B. third node is formed at 30 cm from one end of the string

C. the velocity of a particle at x = 7.5 cm and t = 0.25 s is zero

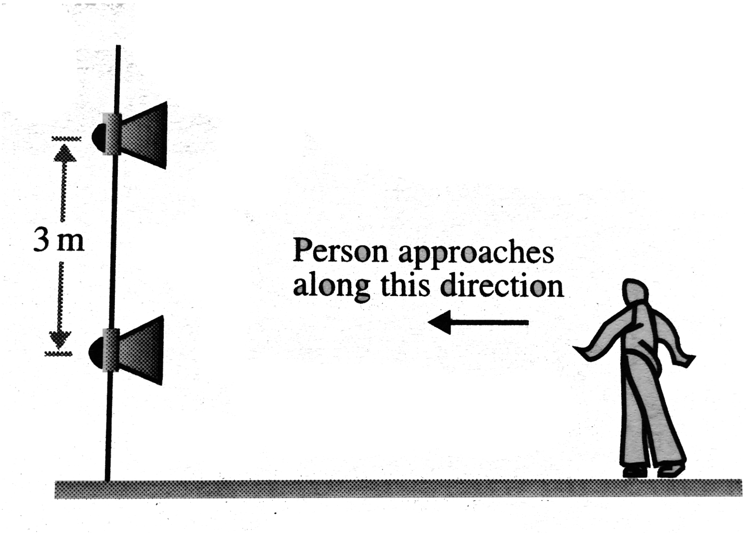
D. equations of the component waves whose superposition gives the above equation are $y_1 = 2\sin\left(\frac{\pi x}{15} - 96\pi\right)$ and $y_2 = 2\sin\left(\frac{\pi x}{15} + 96\pi\right)$

Answer: B::C::D

Watch Video Solution

ADDITIONAL PRACTICE EXERCISE PRACTICE SHEET (ADVANCED) (LINKED COMPREHENSION TYPE QUESTIONS)

1. An oscillator of frequency $680 Hz$ drives two speakers . The speakers are fixed on a vertical pole at a distance $3m$ from each other as shown in Fig. 7.103. A person whose height is almost the same as that of the lower speaker walks towards the lower speaker in a direction perpendicular to the pole. Assuming that there is no reflection of sound from the ground and speed of sound is $v = 340 m/s$, answer the following questions.



As the person walks towards the pole , his distance from the pole when he first hears a minimum in sound intensity is nearly

A. 14.6 m

B. 17.9 m

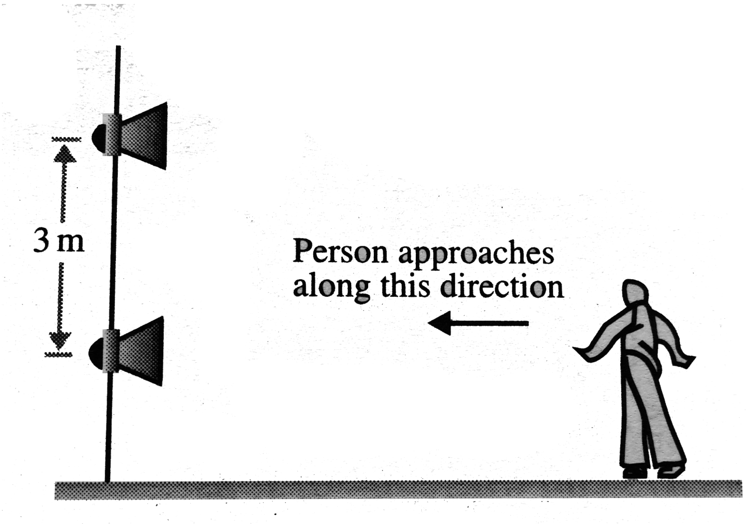
C. 10.1 m

D. 22.4 m

Answer: B

Watch Video Solution

2. An oscillator of frequency $680Hz$ drives two speakers . The speakers are fixed on a vertical pole at a distance $3m$ from each other as shown in Fig. 7.103. A person whose height is almost the same as that of the lower speaker walks towards the lower speaker in a direction perpendicular to the pole. Assuming that there is no reflection of sound from the ground and speed of sound is $v = 340m/s$, answer the following questions.



How far is the person from the pole when he hears a minimum in sound intensity a second time ?

A. 5.6 m

B. 7.8 m

C. 12.4 m

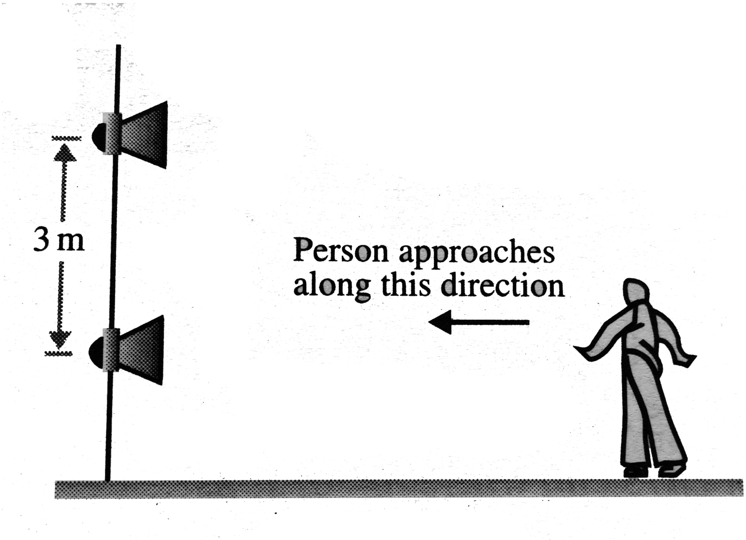
D. 17.6m

Answer: A

Watch Video Solution

3. An oscillator of frequency $680 Hz$ drives two speakers . The speakers are fixed on a vertical pole at a distance $3m$ from each other as shown in Fig. 7.103. A person whose height is almost the same as that of the lower speaker walks towards the lower speaker in a direction perpendicular to the pole. Assuming that there is no reflection of sound from the ground and speed of sound is

$v = 340m/s$, answer the following questions.



As the person walks toward the pole , the total number of times that the person hears a minimum in sound intensity will be

A. 2

B. 8

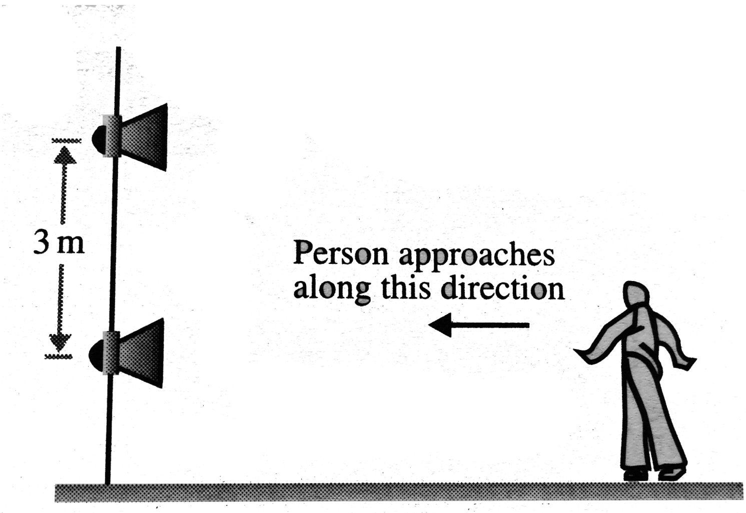
C. 4

D. 6

Answer: D

Watch Video Solution

4. An oscillator of frequency $680Hz$ drives two speakers . The speakers are fixed on a vertical pole at a distance $3m$ from each other as shown in Fig. 7.103. A person whose height is almost the same as that of the lower speaker walks towards the lower speaker in a direction perpendicular to the pole. Assuming that there is no reflection of sound from the ground and speed of sound is $v = 340m/s$, answer the following questions.



At some instant , when the person is at a distance $4m$ from the pole , the wave function (at the person's location) that describes the waves coming from the lower speaker $y = A\cos(kx - \omega t)$, where A is the amplitude , $\omega = 2\pi v$ with $v = 680Hz$ (given) and $k = 2\pi/\lambda$

Wave function (at the person's location) that describes waves coming from the upper speaker can be expressed as :

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

B. $y = A\cos(kx - \omega t + \pi/2)$

C. $y = A\cos(kx - \omega t + 2\pi)$

D. $y = A\cos\left(kx - \omega t + \frac{3\pi}{2}\right)$

Answer: C

Watch Video Solution

5. A vertical pipe open at both ends is partially submerged in water . A tuning fork is unknown frequency is placed near the top of the pipe and made to vibrate . The pipe can be moved up and down and thus length of air column the pipe can be adjusted. For definite lengths of air column in the pipe, standing waves will be set up as a result of superposition of sound waves travelling in opposite directions. Smallest value of length of air column , for which sound intensity is maximum is $10cm$[take speed of sound , $v = 344m/s$].

Answer the following questions.

Frequency of the tuning fork is

A. At the closed end of the air column, there is a displacement node and also a pressure node

B. At the closed end of the air column, there is a displacement node and a pressure antinode

C. At the closed end of the air column, there is a displacement antinode and a pressure node

D. At the closed end of the air column, there is a displacement antinode and also a pressure antinode

Answer: B

Watch Video Solution

6. A vertical pipe open at both ends is partially submerged in water . A tuning fork is unknown frequency is placed near the top of the pipe and made to vibrate . The pipe can be moved up and down and thus length of air column the pipe can be adjusted. For definite lengths of air column in the pipe, standing waves will be set up as a result of superposition of sound waves travelling in opposite directions. Smallest value of length of air column , for which sound intensity is maximum is $10cm$[take speed of sound , $v = 344m/s$].

Answer the following questions.

Frequency of the tuning fork is

A. 1072 Hz

B. 940 Hz

C. 860 Hz

D. 533 Hz

Answer: C

Watch Video Solution

7. A vertical pipe open at both ends is partially submerged in water . A tuning fork is unknown frequency is placed near the top of the pipe and made to vibrate . The pipe can be moved up and down and thus length of air column the pipe can be adjusted. For definite lengths of air column in the pipe, standing waves will be set up as a result of superposition of sound waves travelling in opposite directions. Smallest value of length of air column , for which sound intensity is maximum is $10cm$[take speed of sound , $v = 344m/s$].

Answer the following questions.

Frequency of the tuning fork is

A. 30 cm

B. 45 cm

C. 20 cm

D. 50 cm

Answer: A

Watch Video Solution

8. A vertical pipe open at both ends is partially submerged in water . A tuning fork is unknown frequency is placed near the top of the pipe and made to vibrate . The pipe can be moved up and down and thus length of air column the pipe can be adjusted. For definite lengths of air column in the pipe, standing waves will be set up as a result of superposition of sound waves travelling in opposite directions. Smallest value of length of air column , for which sound intensity is maximum is $10cm$[take speed of sound , $v = 344m/s$].

Answer the following questions.

Length of air column for third resonance will be

A. 30 cm

B. 45 cm

C. 20 cm

D. 50 cm

Answer: D

Watch Video Solution

9. A vertical pipe open at both ends is partially submerged in water . A tuning fork is unknown frequency is placed near the top of the pipe and made to vibrate . The pipe can be moved up and down and thus length of air column the pipe can be adjusted. For definite lengths of air column in the pipe, standing waves will be set up as a result of superposition of sound waves travelling in opposite directions. Smallest value of length of air column , for which sound intensity is maximum is $10cm$[take speed of sound , $v = 344m/s$].

Answer the following questions.

Frequency of the tuning fork is

A. 3400 Hz

B. 2500 Hz

C. 4300 Hz

D. 1720 Hz

Answer: C

Watch Video Solution

ADDITIONAL PRACTICE EXERCISE PRACTICE SHEET (ADVANCED) (INTEGER TYPE QUESTIONS)

1. A source emitting sound of frequency 180 Hz is placed in front of a wall at a distance of 2 m from it. A detector is also placed in front of the wall at the same distance from it. Find the minimum distance between the source and the detector for which the detector detects a maximum of sound. Speed of sound in air $= 360ms^{-1}$.

Watch Video Solution

2. A sonometer wire under tension of 63 N vibrating in its fundamental mode is in resonance with a vibrating tuning fork. The vibrating portion of that sonometer wire has a length of 10 cm and a mass of 1 g. The vibrating tuning fork isnow moved away from the vibrating wire with a constant speed and an observer standing near the sonometer hears one beat per second. Calculate the speed with which the tuning fork is moved if the pseed of sound in air is 300 m/s.

Watch Video Solution

3. Two radio stations broadcast their programs at the same amplitude A, and at slightly different frequencies ω_1 and ω_2 respectively, where ω_2 - ω_1 $= 10^3 Hz$. A detector receives the signals from the two stations simultaneously. It can detect signals only of intensity $\geq 2A^2$.

(i) Find the time intervals between successive maxima of the intensity of the signal received by the detector

(ii) Find the time for which the detector remains idle in each cycle of the intensity of the signal

Watch Video Solution

4. A cylinder of length $1m$ is divided by a thin perfectly flexible diaphragm in the middle. It is closed by similar flexible diaphragams at the ends. The two chambers into which it is divided contain hydrogen and oxygen. The two diaphragms are set in vibrations of same frequency. What is the minimum frequency of these diaphragms for which the middle diaphragm will be motionless? Velocity of sound in hydrogen is $1100 m/s$ and that in oxygen is $300 m/s$.

Watch Video Solution

5. A train approaching a hill at a speed of 40 km/h sounds a whistle of frequency 580 Hz when it is at a distance of 1 km from the hill. A wind with a speed of 40 km/h is blowing in the direction of motion of the train. Find the frequency of the whitle as heard by an observer on the hill.

Watch Video Solution

6. A source of sound of frequency 1.8 kHz moves uniformly along a straight line at a distance 250 m from observer. The velocity of source is 0.8 C where C is the velocity of sound. Find out te frequency of sound received by observer (in kHz) at the moment when the source gets closest to him.

Watch Video Solution

7. A boy sitting on a swing which is moving to an angle of 30° from the vertical is blowing a whistle which has a frequency of 100 Hz. The whistle is at 2.0 m from the point of support of the swing. A girl stands in front of the swing. The maximum frequency she will hear is nearly 10^x Hz (velocity of sound 330 m/s,g= $9.8 m/s^2$). Find x

Watch Video Solution

8. A driver in a stationary car horns which produces sound waves having frequency 2000 Hz. The waves are directed normally towards a reflecting wall. If the wall approaches the car with a velocity u = 3.3

m/s. The change in the frequency of sound after reflection from the wall is x%. Then x

Watch Video Solution

9. A sonometer wire fixed at one end has a solid mass M hanging from its other end to produce tension in it. It is found that a 70cm length of wire produces a certain fundamental frequency when plucked. When the same mass M is hanging in water completely submerged in it, it is found that the length of the wire has to be changed by 5cm in order that it will produced the same fundamental frequency. The density of the material of mass M hanging from the wire is 7.26×10^n . Find n .

Watch Video Solution

10. A band playing music at a frequency f is moving towards a wall at a speed v_h. A motorist is following the band with a speed v_m. If v is the speed of sound, the expression for the beat frequency heard by the motorist is $\frac{n\left(V+V_m\right)V_b}{\left(V^2-V_b^2\right)}$. Then n

Watch Video Solution

EXAMPLE

1. The equation for the displacement of a stretched string is given by $y = 4\sin 2\pi\left[\frac{t}{0.02}-\frac{x}{100}\right]$ where y and x are in cm and t in sec. Determine the (a) direction in which wave is propagating (b) amplitude (c) time period (d) frequency (e) angular frequency (t) wavelength (g) propagation constant (h) velocity ofwave (i) phase constant and (j) the maximum particle velocity.

Watch Video Solution

2. A wave on a string is described by $y(x, t) = A\cos(kx - \omega t)$. (a) Graph y, v_y, and a_y as function of x for time t=0. (b) consider the following points on the string: (i) x=0,(ii) $x = \pi/4k$, (iii) $x = \pi/2k$, (iv)$x = 3\pi/4k$, (v)$x = \pi/k$, (vi)$x = 5\pi/4k$, (vii)$x = 3\pi/2k$, (viii) $x = 7\pi/4k$. For a particle at each of these points at t=0, describes in words whether the particle is moving and in what direction, and whether the particle is speeding up, slowing down, or instantaneously not acceleraring.

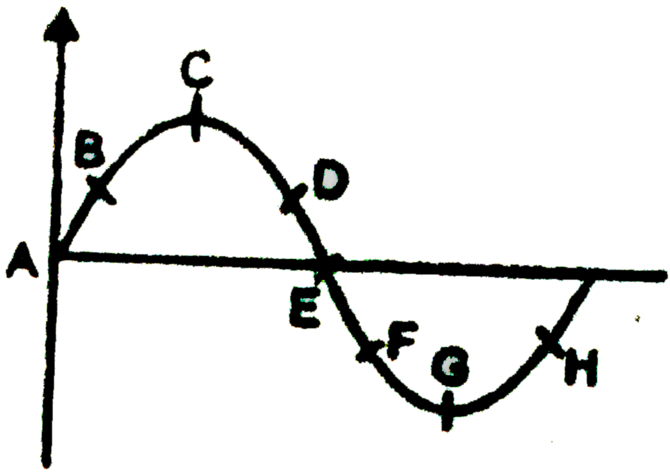
Watch Video Solution

3. A transverse wave is traelling along a string from left to right. The fig. represents the shape of the string (snap-shot) at a given instant. At this instant

(A) Which points have an upward velocity , (B) which points have

downward velocity

(C) which point have zero velocity , (D) which point have maximum magnitude of velocity.



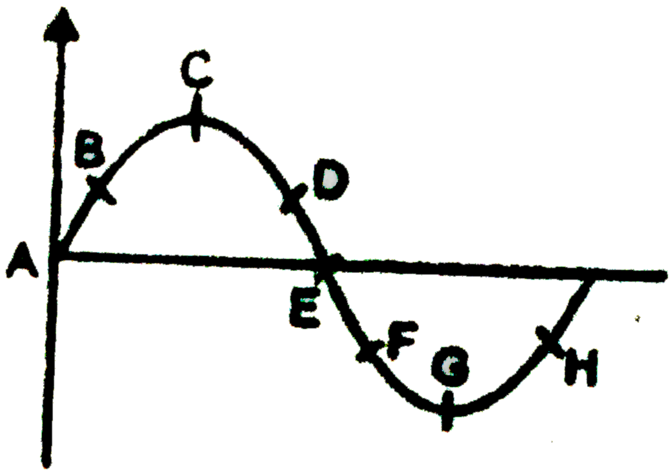
Watch Video Solution

4. A transverse wave is traelling along a string from left to right. The fig. represents the shape of the string (snap-shot) at a given instant. At this instant

(A) Which points have an upward velocity , (B) which points have

downward velocity

(C) which point have zero velocity , (D) which point have maximum magnitude of velocity.



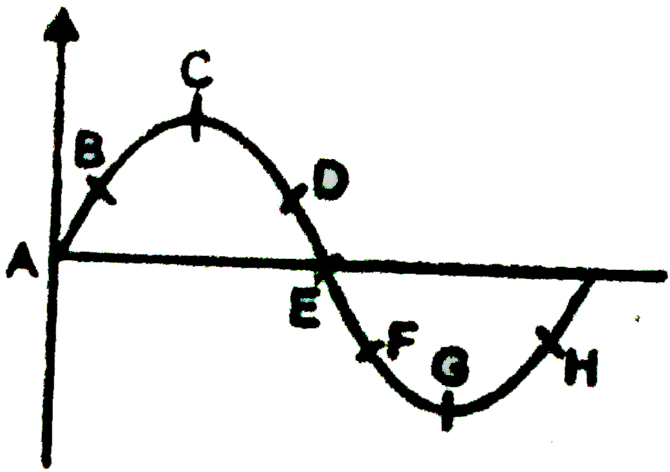
Watch Video Solution

5. A transverse wave is traelling along a string from left to right. The fig. represents the shape of the string (snap-shot) at a given instant. At this instant

(A) Which points have an upward velocity , (B) which points have

downward velocity

(C) which point have zero velocity , (D) which point have maximum magnitude of velocity.



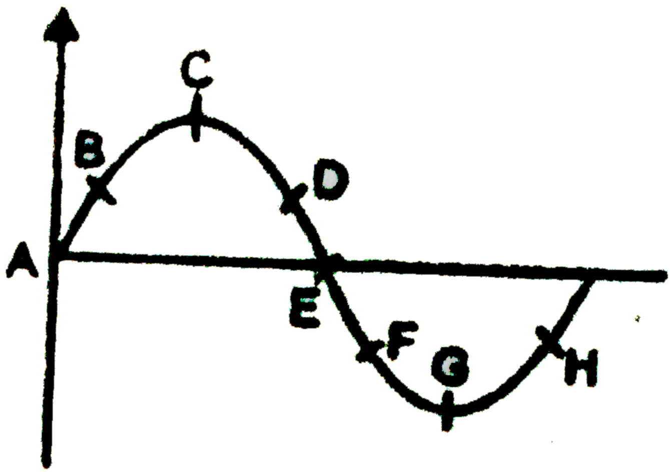
Watch Video Solution

6. A transverse wave is traelling along a string from left to right. The fig. represents the shape of the string (snap-shot) at a given instant. At this instant

(A) Which points have an upward velocity , (B) which points have

downward velocity

(C) which point have zero velocity , (D) which point have maximum magnitude of velocity.



Watch Video Solution

7. 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 $y(x, t)$.

Watch Video Solution

8. 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. ,

Watch Video Solution

9. A wire of uniform cross-section is stretched berween two points I w apart. The wire is fixed at one end und u weight of 9 kg is hung over a pulley at the other end produces fundamental frequency of 750 Hz.

(a) What is the velocity of transverse waves propagating in the wire ?

(b) If now the suspended weight is submerged in a liquid of density (5/9) that of the weight, what will be the velocity and frequency of the waves propagating along the wire ?

Watch Video Solution

10. A wire of uniform cross-section is stretched berween two points I w apart. The wire is fixed at one end und u weight of 9 kg is hung over a pulley at the other end produces fundamental frequency of 750 Hz.

(a) What is the velocity of transverse waves propagating in the wire ?

(b) If now the suspended weight is submerged in a liquid of density (5/9) that of the weight, what will be the velocity and frequency of the waves propagating along the wire ?

Watch Video Solution

11. A uniform thin rope of length 12 m and mass 6 kg hangs vertically from a rigid support and block of mass 2kg is attached to its free end. A transverse short wave-train of wavelength 6 cm is produced at the lower end of the rope. What is the wavelength of the wavetrain (in cm) when it reaches the top of the rope?

Watch Video Solution

12. A wave pulse starts propagating in the +x-direction along a non-uniform wire of length 10 m with mass per unit length given by $\mu = \mu_0 + ax$ and under a tension of 100 N. find the time taken by a pulse to travel from the lighter end (x=0) to the heavier end. $\mu_0 = 10^2 kg/m$ and a=9x10^(-3) kg/m^(2).

Watch Video Solution

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

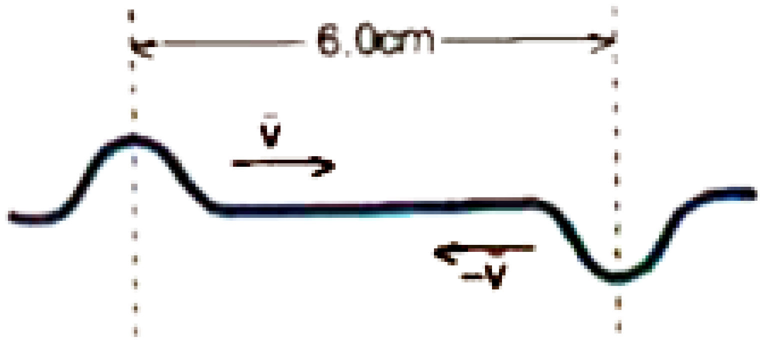
$y(x = 0, t) = 8\sin 4t(cm)$

Neglect the gravitattional force. The string'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?

Watch Video Solution

14. In Figure. two pulses travel along a string in opposite directions.

The wave speed v is 2.0 mls and the pulses are 6.0 cm apart at t =0.



(a) Sketch the wave patterns when t is equal to 20 ms.

(b) In what form (or type) is the energy ofthe pulse at t= 15 ms?

Watch Video Solution

15. The vibrations of a string of length 60 cm fixed at both ends are

represented by the equation $y = 4\sin\left(\frac{\pi x}{15}\right)\cos(96\pi t)$, where x and y are in cm and t in seconds.

(a)What is the maximum displacement of a point at $x = 5cm$?

(b)Where are the nodes located along the string?

(c)What is the velocity of the particle at x=7.5cm and t=0.25s?

(d)Write down the equations of the component waves whose superposition gives the above wave.

Watch Video Solution

16. The vibrations of a string of length 60 cm fixed at both ends are represented by the equation $y = 4\sin\left(\frac{\pi x}{15}\right)\cos(96\pi t)$, where x and y are in cm and t in seconds.

(a)What is the maximum displacement of a point at $x = 5cm$?

(b)Where are the nodes located along the string?

(c)What is the velocity of the particle at x=7.5cm and t=0.25s?

(d)Write down the equations of the component waves whose superposition gives the above wave.

Watch Video Solution

17. The vibrations of a string of length 60 cm fixed at both ends are represented by the equation $y = 4\sin\left(\frac{\pi x}{15}\right)\cos(96\pi t)$, where x and y are in cm and t in seconds.

(a)What is the maximum displacement of a point at $x = 5cm$?

(b)Where are the nodes located along the string?

(c)What is the velocity of the particle at x=7.5cm and t=0.25s?

(d)Write down the equations of the component waves whose superposition gives the above wave.

Watch Video Solution

18. The vibrations of a string of length 60 cm fixed at both ends are represented by the equation $y = 4\sin\left(\frac{\pi x}{15}\right)\cos(96\pi t)$, where x and y are in cm and t in seconds.

(a)What is the maximum displacement of a point at $x = 5cm$?

(b)Where are the nodes located along the string?

(c)What is the velocity of the particle at x=7.5cm and t=0.25s?

(d)Write down the equations of the component waves whose superposition gives the above wave.

Watch Video Solution

19. A standing wave is formed by two harmonic waves, $y_1 = A\sin(kx - \omega t)$ and $y_2 = A\sin(kx + \omega t)$ travelling on a string in opposite directions. Mass density is 'ρ' and area of cross section is S. Find the total mechanical energy between two adjacent nodes on the string.

Watch Video Solution

20. A sonometer wire has a length 114 cm between two fixed ends. Where should two bridges be placed to so as divide the wire into three segments whose fundamental frequencies are in the ratio 1:3:4

.

Watch Video Solution

21. A string 120 cm in length sustains a standing wave, with the points of string at which the displacement amplitude is equal to $\sqrt{2}$ mm being separated by 5.0 cm, Find the maximum displacement amplitude. Also find the harmonic corresponding to this wave.

Watch Video Solution

22. An aluminium wire of cross-sectional area $\left(10^{-6}\right)m^2$ is joined to a steel wire of the same cross-sectional area. This compound wire is stretched on a sonometer pulled by a weight of 10kg. The total length of the compound wire between the bridges is 1.5m of which the aluminium wire is $0.6m$ and the rest is steel wire. Transverse vibrations are setup in the wire by using an external source of variable frequency. Find the lowest frequency of excitation for which the standing waves are formed such that the joint in the wire is a node. What is the total number of nodes at this frequency? The density of aluminium is $2.6 \times \left(10^3\right)kg/m^3$ and that of steel is $1.04 \times 10^4 kg/m^2\left(g = 10m/s^2\right)$

Watch Video Solution

23. Determine the speed of sound waves in water, and find the wavelength of a wave having a frequency of 242 Hz.

Take $B_{\text{water}} = 2 \times 10^9 Pa.$

Watch Video Solution

24. Three component sinusoidal waves progressing in the same directions along the same path have the same period but their amplitudes are $A, \frac{A}{2}$ and $\frac{A}{3}$. The phases of the variation at any position x on their path at time $t = 0 are 0$, - $\frac{\pi}{2}$ and - π respectively. Find the amplitude and phase of the resultant wave.

Watch Video Solution

25. Two sources of intensity I and 4I are used in an interference experiment. Find the intensity at a point where the waves from two sources superimpose with a phase difference of (a) zero, (b) $\pi/2$, (c) π and (d) ratio of maximum and minimum intensity.

Watch Video Solution

26. In a Hali, a person recives direct sound waves from a source $120m$ away. He also receives wave from the same source which reach him after being reflected from the 25m high ceilling at a point half way between them. The two waves interface construtively for wave length (in meters).

Watch Video Solution

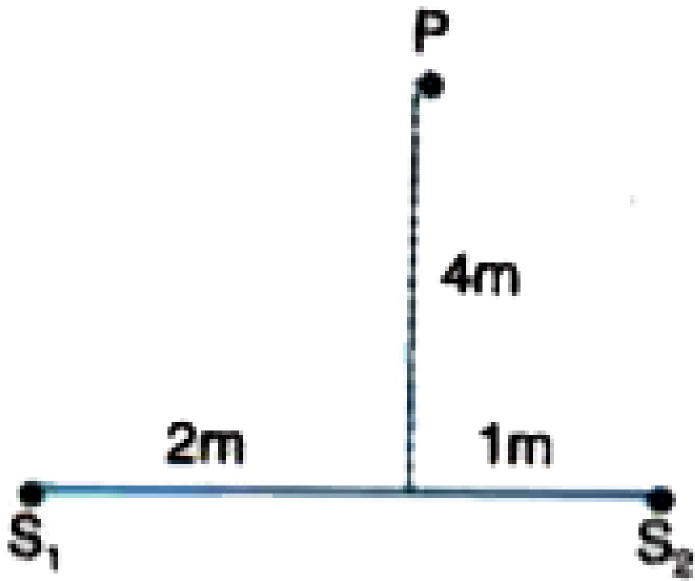
27. Two speakeer connected to the same source of fixed frequency are placed 2m apart in a box. A sensitive microphone placed at a distance of 4m from the midpoint alon the perpendicular bisector shown maximum response. The box is slowly rotated till the speaker are in line with the microphone, The distance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

Watch Video Solution

28. Two sound sources S_1 and S_2 emit pure sinusoidal waves in phase. If the speed of sound is 350 m/s,

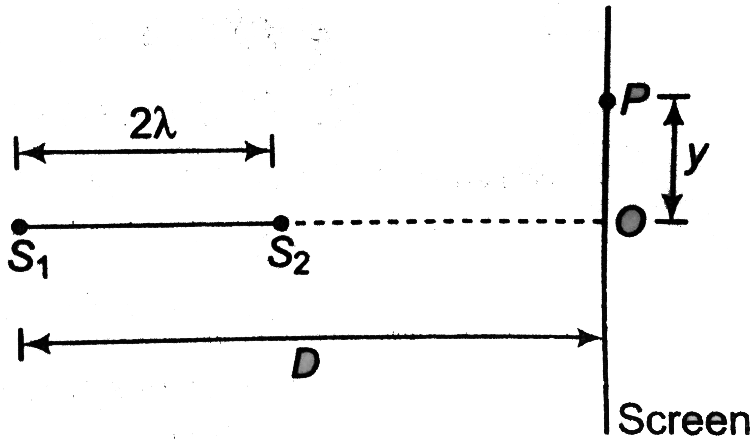
(a) For what frequencies does constructive interference occur at P?

(b) For what frequencies does destructive interference occur at P?



Watch Video Solution

29. Two coherent narrow slits emitting sound of wavelength λ in the same phase are placed parallet to each other at a small separation of 2λ . The sound is delected by maving a delector on the screen at a distance $D(> > \lambda)$ from the slit S_1 as shows in figure. Find the distance y such that the intensity at P is equal to intensity at O .



Watch Video Solution

30. If two sund waves $y_1 = 0.3\sin 596\pi\left[t - \frac{x}{330}\right]$ and $y_2 = 0.5\sin 604\pi\left[t - \frac{x}{330}\right]$ are superposed, what will be the

(a) frequency of resultant wave

b) frequency at which the amplitude of resultant waves varies

(c) Frequency at which beats are produced. Find also the ratio of maximum and minimum intensities of beats.

Watch Video Solution

31. A tuning fork produces 4 beats per second with another tuning fork of frequency 256 Hz. The first one is now loaded with a little wax and the beat frequency is found to increase to 6 per second. What was the original frequency of the tuning fork ?

Watch Video Solution

32. An engine approaches a hill with a constant speed. When it is at a distance of 0.9 km it blows a whistle, whose echo is heard by the driver after 5 sec. If the speed ofsound in air is 330 m/s, calculate the speed of the engine.

Watch Video Solution

33. A person standing between two parallel hills fires a gun. He hears the first echo after $\frac{3}{2}$ s, and a second echo after $\frac{5}{2}$ s. If speed of sound is $332m/s$, Calculate the distance between the hills. When will he hear the third echo?

Watch Video Solution

34. For a certain organ pipe, three successive resonance frequencies are observer at $425, 595$ and $765H_Z$ respectively. Taking the speed of sound in air to be $340m/s$, (a) explain whether the pipe is closed at one or open at boyh ends. (b) determine the fundamental frequency and length of the pipe.

Watch Video Solution

35. A tube $1.0m$ long is closed at one end. A stretched wire is placed near the open end. The wire is $0.3m$ long and a mass of $0.01kg$. It is held fixed at both ends and vibrates in its fundamental mode. It sets the air column in the tube into vibration at its fundamental frequency by resonance. Find

(a) the frequency of oscillation of the air column and

(b) the tension in the wire.

Speed of sound in air = $330m/s$.

Watch Video Solution

36. Two open organ pipes 80 and 81 cm long found to give 26 beats in 10 sec, when each is sounding its fundamental note. Find the velocity of sound in air.

Watch Video Solution

37. A cylinder of length $1m$ is divided by a thin perfectly flexible diaphragm in the middle. It is closed by similar flexible diaphragams at the ends. The two chambers into which it is divided contain hydrogen and oxygen. The two diaphragms are set in vibrations of same frequency. What is the minimum frequency of these diaphragms for which the middle diaphragm will be motionless? Velocity of sound in hydrogen is $1100m/s$ and that in oxygen is $300m/s$.

Watch Video Solution

38. Two tuning forks with natural frequencies 340 Hz each move relative to a stationary observer. One fork moves away from the observer, while the other moves towards the observer at the same speed. The observer hears beats of frequency 3 Hz. Find the speed of the tuning forks (speed of sound is $340\frac{m}{s}$).

Watch Video Solution

39. When a train is approaching the observer, the frequency of the whistle is 100 cps. When it has passed the observer, it is 50 cps. The frequency when the observer moves with the train, is :

Watch Video Solution

40. A siren emitting a sound of frequency $1000H_Z$ moves away from you towards a cliff at a speed of $10m/s$.

(a) What is the frequency of the sound you hear coming directly from the sirven ?

(b) What is the frequency of sounds you hear reflected off the cliffb ?

(c) What beat frequency would you hear ? Take the speed of sound in air as $330m/s$.

Watch Video Solution

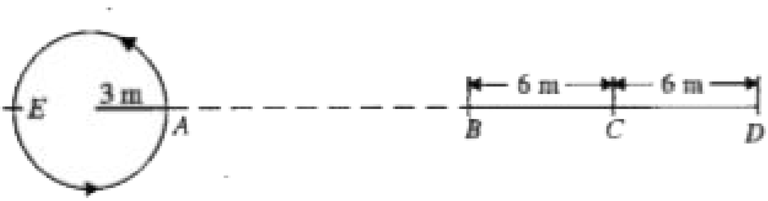
41. A car approaching a crossing C at a speed of $20m/s$ sounds a horn of frequency $500H_Z$ when $80m$ from the crossing . Speed of sound in air is $330m/s$. What frequency is heard by an observer (at rest) $60m$ from the crossing on the straight road which crosses car road at right angles ?

Watch Video Solution

42. A whistle of frequency $540H_Z$ rotates in a circle of radius $2m$at a linear speed of $30m/s$. What is the lowest and highest frequency heard by an observer a long distance away at rest with respect to the centre of circle ? Take speed of sound of sound in air as $330m/s$. Can the apparent frequency be ever equal to actual ?

Watch Video Solution

43. A source of sound is moving along a circular orbit of radius 3 m with an angular velocity of 10 rad/s. A sound detector located far away from the source is executing linear S.H.M. along the line BD (see Fig. 14.4.13) with an amplitude BC = CD=6m. The frequency of oscillation of the detector is $5/\pi$ per second. The source is at the point BA when the detector is at the point B. If the source epiits a continuous sound wave of frequency 340 Hz, find the maximum and the minimum frequencies recorded by the detector.



Watch Video Solution

44. A galaxy moves with respect to us so that sodium light of 589.0 nm is observed at 589.6 nm. The speed of the galaxy is

Watch Video Solution

EXERCISE (LONG ANSWER QUESTIONS)

1. Explain the formation of standing waves in a string clamped at both ends and discuss the various modes of vibration.

Watch Video Solution

2. What are Harmonics and Overtones? How are they formed in an open pipe? Derive the eqautions for the frequencies of the harmonic produced in an open pipe.

Watch Video Solution

3. How are stationary waves formed in a closed pipe? Explain the various modes of vibrations in a closed pipe and establish the relation between their frequencies.

Watch Video Solution

4. What is Doppler effect? Find an expression for the apparent frequency heard when the source is in motion and the listener is at rest. What is the limitation of Doppler effect?

Watch Video Solution

5. What is Doppler effect? Find an expression for the apparent frequency heard when the source is in motion and the listener is at rest. What is the limitation of Doppler effect?

Watch Video Solution

EXERCISE (SHORT ANSWER QUESTIONS)

1. What are transverse waves? Explain with an example.

Watch Video Solution

2. What is a plane progressive simple harmonic wave ? Establish equation for this wave in two different forms.

Watch Video Solution

3. Explain the reflection of waves in string at fixed end and free end.

Watch Video Solution

4. State the laws of vibrating strings.

Watch Video Solution

5. Explain the harmonic on a stretched string with sutiable illustrations.

Watch Video Solution

6. What are forced vibrations ? Give one example to illustrate your answer.

Watch Video Solution

7. What are .beats. ? Explain their production. State the necessary conditions for the production of beats.

Watch Video Solution

8. What is resonance ? What is resonant frequency ?

Watch Video Solution

9. Explain the reflection of waves at closed and open ends.

Watch Video Solution

10. Draw diagrams to show the various modes of vibration in (i) an open pipe and (ii) a closed pipe.

Watch Video Solution

11. Explain the formation of standing waves in a string clamped at both ends and discuss the various modes of vibration.

Watch Video Solution

12. What are the applications of Doppler effect?

Watch Video Solution

13. Name the three characteristics of sound.

Watch Video Solution

EXERCISE (VERY SHORT ANSWER QUESTIONS)

1. Name the parameters of a progressive wave?

Watch Video Solution

2. How are the wave velocity v, frequency n and wavelength λ of a wave related? Derive the relationship.

Watch Video Solution

3. State two differences between light and sound waves.

Watch Video Solution

4. What is the distance between two crests with a phase difference of 4π?

Watch Video Solution

5. What is the phase difference between a compression and next rarefaction?

Watch Video Solution

6. What type of mechanical waves do you expect to exist in (a) vacuum (b) air (c) inside water (d) rock (e) on the surface of a liquid.

Watch Video Solution

7. Is it possible to have longitudinal waves on a string? A transverse wave on a steel rod?

Watch Video Solution

8. How many times a particle will reach maximum displacement during the time taken by the wave to advance by one wavelength?

Watch Video Solution

9. How can you say that the equation $y = A\sin(\omega t = kx)$ represents a progressive wave?

Watch Video Solution

10. What is the significance of in the case of $\frac{\omega}{k}$ in the case of a progressive wave given by $y = A\sin(\omega t - kx)$?

Watch Video Solution

11. State the principle of superposition of waves.

Watch Video Solution

12. What are the conditions required for a wave to get reflected?

Watch Video Solution

13. What is the phase difference between the incident wave and the reflected wave in the following ?

1. Wave reflected from rigid boundary.

2. Wave reflected from free boundary.

Watch Video Solution

14. When sound waves travel from air to water which of these remains constant ?

Watch Video Solution

15. What is a stationary wave? What is the distance between a node and the succeeding antinode of a stationary wave?

Watch Video Solution

16. Which type of waves are formed due to vibrations of stretched strings?

Watch Video Solution

17. When stretched string vibrates in two segments, how many nodes and antinodes will be there?

Watch Video Solution

18. What is the frequency of 9^{th} overtone on a stretched string of length l and linear density 'm', when the tension is "T"?

Watch Video Solution

19. If a stretched string is plucked at the centre

Watch Video Solution

20. A wire of length 'l' is vibrating in three segments. What is the wavelength of the note emitted?

Watch Video Solution

21. What is the ratio of the frequency of fouth overtone to the fundamental frequency of a stretched string?

Watch Video Solution

22. What happens to the fundamental frequency of a stretched string when the tension is quadrupled?

Watch Video Solution

23. What happens to the fundamental frequency of a stretched string when its linear density becomes 1/4 of its intial value?

Watch Video Solution

24. Two identical wires on a sonometer, are stretched with the same tension 'T'. if their lengths are in the ratio 1:2 what is the ratio of their frequencies?

Watch Video Solution

25. When do the paper riders on a sonometer wire fly off?

Watch Video Solution

26. When temperature increases, the frequency of a tuning fork

Watch Video Solution

27. What happens to the frequency of a tuning fork.

When it is loaded with little wax.

Watch Video Solution

28. What happens to the frequency of a tuning fork.

When it is filled?

Watch Video Solution

29. At resonance, the amplitude of forced oscillations is

Watch Video Solution

30. State the condition for the resonance to occur.

Watch Video Solution

31. The soldiers marching on a suspended bridge are advised to go out of steps. Why ?

Watch Video Solution

32. Light can travel in vacuum but not sound, becaouse

Watch Video Solution

33. Discuss Newton's formula for velocity of sound in air medium and apply Laplace's correction.

Watch Video Solution

34. "The velocity of sound is generally greater in solids than in gas at N.T.P." Why?

Watch Video Solution

35. The velocity of sound in oxygen in lesser than in hydrogen.Explain.

Watch Video Solution

36. Use the formula $v = \sqrt{\frac{\gamma P}{\rho}}$ to explain why the speed of sound in air

(a) is independent of pressure,

(b) increases with temperature,

(c) increases with humidity.

Watch Video Solution

37. Use the formula $v = \sqrt{\frac{\gamma P}{\rho}}$ to explain why the speed of sound in air

(a) is independent of pressure,

(b) increases with temperature,

(c) increases with humidity.

Watch Video Solution

38. Three identical sound waves pass through an air column, a brass rod and an oil pipe of same length. In which of the three will it take the least time to reach the other end?

Watch Video Solution

39. Does the law of conservation of energy hold good in case of interference of waves? Explain.

Watch Video Solution

40. Two identical travelling waves, moving in the same direction are out of phase by $\pi/2$ rad. What is the amplitude of the resultant wave in terms of the common amplitude y_m of the two combining waves?

Watch Video Solution

41. What is the resultant displacement of the particles when a compression falls on a rarefaction?

Watch Video Solution

42. What happens when a crest falls on the crest during superposition of waves?

Watch Video Solution

43. What are beats? What is beat frequency?

Watch Video Solution

44. Mention the applications of beats,

Watch Video Solution

45. Distinguish between interference and beats.

Watch Video Solution

46. Two waves of frequencies 256 & 250 are forming beats. What will be the beat frequency?

Watch Video Solution

47. A sound wave travelling along an air column of a pipe gets reflected at the open end of the pipe. What is the phase difference between the incident and reflected waves at the open end?

Watch Video Solution

48. What is the ratio of frequencies of harmonics in an air column of same length in a closed pipe.

Watch Video Solution

49. What is the ratio of frequencies of harmonics in an air column of same length in an open pipe.

Watch Video Solution

50. What is the distance between the closed end and open end of a pipe vibrating in the 7th harmonic?

Watch Video Solution

51. What is the distance between two ends of open pipe vibrating in the 3rd overtone?

Watch Video Solution

52. What is "End correction" in resonating air column?

Watch Video Solution

53. If oil of density higher than water is used in place of water in a resonance tube how does the frequency change?

Watch Video Solution

54. What is Doppler effect? Find an expression for the apparent frequency heard when the source is in motion and the listener is at rest. What is the limitation of Doppler effect?

Watch Video Solution

55. Why do we hear a higher frequency apparently when we approach a stationary sounding railway engine?

Watch Video Solution

56. What is the reason for listening a higher frequency when a source of sound moves towards a stationary listener?

Watch Video Solution

57. Write any two applications of Doppler effect.

Watch Video Solution

58. A : In Doppler's effect the value of apparent frequency depends on the relative motion between source and observer .

R : The change in frequency in Doppler effect is independent from the distance between source and observer .

Watch Video Solution

59. (a) Does the change in frequency due to Doppler effect depend on the distance between source (b)Does the change in frequency due to Doppler effect on the fact that source is moving towards the observer or observer is moving towards the source ?

Watch Video Solution

60. The characteristics of sound which is used to differentiate the sound of male and female

Watch Video Solution

PROBLEMS (LEVEL - I)

1. 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

Watch Video Solution

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

Watch Video Solution

3. 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

Watch Video Solution

4. 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 $x = 2cm$

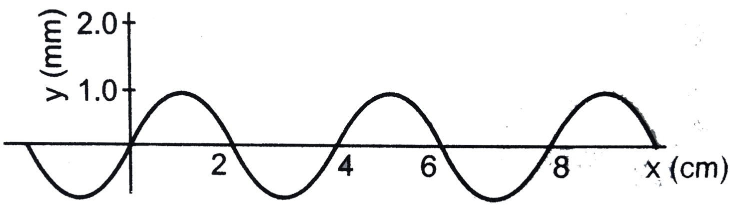
(b) wavelength

(c) velocity of the wave and

(d) frequency of the wave

Watch Video Solution

5. Figure shows a plot of the transverse displacements of the particles of a string at t = 0 through which a travelling wave is passing in the positive x-direction. The wave speed is $20cms^{-1}$. Find (a) the amplitude, (b) the wavelength, (c) the wave number and (d) the frequency of the wave.



Watch Video Solution

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

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

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

Watch Video Solution

Watch Video Solution

7. A sound wave of frequency 100 Hz is travelling in air. The speed of sound in air is $350 ms^{-1}$ (a) By how much is the phase changed at a given point in 2.5 ms ? (b) What is the phase difference at a given instant between two points separated by a distance of 10.0 cm along the direction of propagation ?

Watch Video Solution

8. A sound wave of frequency 100 Hz is travelling in air. The speed of sound in air is $350 ms^{-1}$ (a) By how much is the phase changed at a given point in 2.5 ms ? (b) What is the phase difference at a given instant between two points separated by a distance of 10.0 cm along the direction of propagation ?

Watch Video Solution

9. A progressive wave of frequency 500 Hz is travelling with a speed of 350 m/s. A compressional maximum appears at a place at a given instant. The minimum time interval after which of refraction maximum occurs at the same place is

Watch Video Solution

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

Watch Video Solution

11. 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.

Watch Video Solution

12. A 4.0 kg block is suspended from the ceiling of an elevator through a string having a linear mass desity of $19.2 \times 10^{-3} kgm^{-1}$. Find the speed (with respect to the string) with which a wave pulse can proceed on the string if the elavator accelerates up at the rate of $2.0ms^{-2}$. $Take g = 10ms^{-2}$.

Watch Video Solution

13. Transverse waves are generated in two uniform wires A and B of the same material by attaching their free ends to a vibrating source of frequency 200 Hz. The Area of cross section of A is half that of B while tension on A is twice than on B. The ratio of wavelengths of the transverse waves in A and B is

Watch Video Solution

14. Two progressive transverse waves given by $y_1 = 0.07\sin\pi(12x - 500t)$ and $y_2 = 0.07\sin\pi(12x500t)$ travelling along a stretched string form nodes and antinodes. What is the displacement at the nodes.

Watch Video Solution

15. Two progressive transverse waves given by $y_1 = 0.07\sin\pi(12x - 500t)$ and $y_2 = 0.07\sin\pi(12x500t)$ travelling along a stretched string form nodes and antinodes. What is the displacement at the antinodes.

Watch Video Solution

16. Two progressive transverse waves given by $y_1 = 0.07\sin\pi(12x - 500t)$ and $y_2 = 0.07\sin\pi(12x + 500t)$ travelling along a stretched string form nodes and antinodes.What is the wavelength ?

Watch Video Solution

17. A wave of length 2m is superposed on its reflected wave to form a stationary wave. A node is located at x = 3m. The next node will be located at x=

Watch Video Solution

18. The equation for the vibration of a string fixed at both ends vibrating in its second harmonic is given by $y = 2\sin\left(0.3cm^{-1}\right)x\cos\left(\left(500\pi s^{-1}\right)t\right)cm$. The length of the string is :

Watch Video Solution

19. Two wires are kept tight between the same pair of supports. The tensions in the wires are in the ratio 2 : 1, the radii are in the ratio 3 : 1 and the densities are in the ratio 1 : 2. Find the ratio of their fundamental frequencies.

Watch Video Solution

20. A one-metre long stretched string having a mass of 40 g is attached to a tuning fork. The fork vibrates at 128 Hz in a direction perpendicular to the string. What should be the tension in the string if it is to vibrate in four loops ?

Watch Video Solution

21. A somoneter wire resonates with a given tuning fork forming standing waves with five antindoes between the two bridges when a mass of 9 kg is suspended from the wire. Resonates with the same tuning fork forming three antindoes for the same postions of the bridges. the value of M is

Watch Video Solution

22. A guitar string is 90 cm long and has a fundamental frequency of 124 Hz. Where should it be pressed to produce a fundamental frequency of 186 Hz?

Watch Video Solution

23. the frequency of a sonometer wire is 10 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

Watch Video Solution

24. When the tension in a string is increased by 44%. the frequency increased by 10Hz the frequency of the string is

Watch Video Solution

25. A steel wire of length 1 m, mass 0.1 kg and uniform cross-sectional area $10^{-6}m^2$ is rigidly fixed at both ends. The temperature of wire is lowered by 20°C. If transverse waves are set up by plucking the string in the middle, calculate the frequency (In S.I. units) of the fundamental mode of vibration. Young's modulus of steel

$= 2 \times 10^{11} N/m^2$, coefficient of linear expansion of steel $= 1.21 \times 10^{-6} (degC)^{-1}$.

Watch Video Solution

26. A metallic wire with tension T and at temperature $30\,^{\circ}C$ vibrates with its fundamental frequency of $1kHz$. The same wire with the same tension but at $10\,^{\circ}C$ temperature vibrates with a fundamental frequency of $1.001kHz$. The coefficient of linear expansion of the wire is equal to $10^{-K}.\,^{\circ}C$. Find $2K$.

Watch Video Solution

27. Three resonant frequencies of a string are 90, 150 and 210 Hz. (a) Find the highest possible fundamental frequency of vibration of this string. (b) Which harmonics of the fundamental are the given frequencies ? (c) Which overtones are these frequencies ? (d) If the length of the string is 80 cm, what would be the speed of a transverse wave on this string ?

Watch Video Solution

28. Three resonant frequencies of a string are 90, 150 and 210 Hz. (a) Find the highest possible fundamental frequency of vibration of this string. (b) Which harmonics of the fundamental are the given frequencies ? (c) Which overtones are these frequencies ? (d) If the length of the string is 80 cm, what would be the speed of a transverse wave on this string ?

Watch Video Solution

29. Three resonant frequencies of a string are 90, 150 and 210 Hz. (a) Find the highest possible fundamental frequency of vibration of this string. (b) Which harmonics of the fundamental are the given

frequencies ? (c) Which overtones are these frequencies ? (d) If the length of the string is 80 cm, what would be the speed of a transverse wave on this string ?

Watch Video Solution

30. Three resonant frequencies of string with both rigid ends are 90, 150 and 210 Hz. If the length of the string is 80 cm, what is the maximum possible speed of the transverse wave in the string?

Watch Video Solution

31. The equation of a travelling sound wave is $y = 6.0\sin(600t - 1.8x)$ where y is measured in $10^{-5}m$, t in second and x in metre. (a) Find the ratio of the displacement amplitude of the particles to the wavelength of the wave. (b) Find the ratio of the velocity amplitude of the particles to the wave speed.

Watch Video Solution

32. The equation of a travelling sound wave is $y = 6.0\sin(600t - 1.8x)$ where y is measured in $10^{-5}m$, t in second and x in metre. (a) Find the ratio of the displacement amplitude of the particles to the wavelength of the wave. (b) Find the ratio of the velocity amplitude of the particles to the wave speed.

Watch Video Solution

33. The height of a cloud above the earth is 100 m. If an observer hears the sound of thunder 0.3 s after the lightening is seen what is the velocity of sound on that day?

Watch Video Solution

34. In a liquid with density $900kg/m^3$, lonfitudinal waves with frequency $250H_Z$ are found to have wavelength $8.0m$. Calculate the bulk modulus of the liquid.

Watch Video Solution

35. The speed of sound as measured by a student in the laboratory on a winter day is $340\frac{m}{s}$ when the room temperature is $17^\circ C$. What speed will be measure another student repeating the experiment on a day when the room temperature is $32 \circ C$?

Watch Video Solution

36. At what temperature is the speed of sound in air double of its speed of at $0^\circ C$?

Watch Video Solution

37. The ratio of densities of nitrogen and oxygen is 14 : 16. The temperature at which the speed of sound in nitrogen will be same as that in oxygen at $55^\circ C$ is

Watch Video Solution

38. An organ pipe has two successive harmonics with frequencies 400 and $560H_Z$. The velocity of sound in air is $344m/s$.

(a) Is the an open or a closed pipe?

(b) What two harmonics are there?

(c) What is the length of the pipe?

Watch Video Solution

39. An organ pipe has two successive harmonics with frequencies 400 and $560H_Z$. The velocity of sound in air is $344m/s$.

(a) Is the an open or a closed pipe?

(b) What two harmonics are there?

(c) What is the length of the pipe?

Watch Video Solution

40. An organ pipe has two successive harmonics with frequencies 400 and $560H_Z$. The velocity of sound in air is $344m/s$.

(a) Is the an open or a closed pipe?

(b) What two harmonics are there?

(c) What is the length of the pipe?

Watch Video Solution

41. The fundamental frequency of a closed pipe is $220H_Z$.

(a) Find the length of this pipe.

(b) The second overtone of this pipe has the same frequency as the third harmonic of an open pipe. Find the length of this open pipe. Take speed of sound in air $345m/s$.

Watch Video Solution

42. The fundamental frequency of a closed pipe is $220H_Z$.

(a) Find the length of this pipe.

(b) The second overtone of this pipe has the same frequency as the third harmonic of an open pipe. Find the length of this open pipe. Take speed of sound in air $345m/s$.

Watch Video Solution

43. 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

Watch Video Solution

44. 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

Watch Video Solution

45. A tuning fork produces 4 beats per second with another tuning fork of frequency $256H_Z$. The first one is now loaded with a little wax the beat frequency is found to increase to 6 per second. What was the original frequency of the first tuning fork?

Watch Video Solution

46. Two tuning forks when sounded together produce 5 beats in 2 seconds. The time interval between two successive maximum intensities of sound is

Watch Video Solution

47. Two progressive waves $y_1 = 4\sin 400\pi t$ and $y_2 = 3\sin 404\pi t$ moving in the same direction superpose on each other producing beats. Then the number of beats per second and the ratio of maximum to minimum intensity of the resultant waves are respectively

Watch Video Solution

48. Calculate the frequency of beats produced in air when two sources of sound are activated, one emitting a wavelength of 32 cm and the other of 32.2 cm. The speed of sound in air is $350ms^{-1}$.

Watch Video Solution

Watch Video Solution

49. Two sitar strings A and B playing the note 'Ga' are slightly out of tune and produce beats of frequency 6 Hz. The tension in the string A is slightly reduced and the beat frequency is found to reduce to 3 Hz. If the original frequency of A is 324 Hz, what is the frequency of B?

Watch Video Solution

50. The frequency of a tuning fork A is 2% more than the frequency of a standard tuning fork. The frequency of another fork B is 3% less than the frequency of standard tuning fork . If 6 beats s^{-1} are heard when the two tuning forks A and B are excited , the frequency of A is

Watch Video Solution

51. A man standing at some distance from a cliff hears the echo of sound after 2s. He walks 495 m away from the cliff. He produces a sound there and receives the echo after 5s. What is the speed of sound?

Watch Video Solution

52. A motor car approaching a cliff with a velocity of 90 kmph sounds the horn and the echo is heard after 20 seconds. Assuming the velocity of sound in air to be 332 ms, calculate the distance between the car and the cliff when the horn is sounded.

Watch Video Solution

53. A person standing between two parallel hills fires a gun. He hears the first echo after $\frac{3}{2}$ s, and a second echo after $\frac{5}{2}$ s. If speed of sound is $332 m / s$, Calculate the distance between the hills. When will he hear the third echo?

Watch Video Solution

54. A tuning fork of unknown frequency makes 5 beats per second with another tuning fork which can cause a closed organ pipe of length 40 cm to vibrate in its fundamental mode. The beat frequency decreases when the first tuning fork is slightly loaded with wax. Find its original frequency. The speed of sound in air is $320 ms^{-1}$

Watch Video Solution

55. A traffic policeman standing on a road sounds a whistle emitting the main frequency of 2.00 kHz. What could be the apparent frequency heard by a scooter driver approaching the policeman at a speed of $36.0 kmh^{-1}$? Speed of sound in air $= 340 ms^{-1}$.

Watch Video Solution

56. A person riding a car moving at $72kmh^{-1}$ sounds a whistle emitting a wave of frequency 1250 Hz. What frequency will be heard by another person standing on the road (a) in front of the car (b) behind the car ? Speed of sound in air $= 340ms^{-1}$.

Watch Video Solution

57. A person riding a car moving at $72kmh^{-1}$ sounds a whistle emitting a wave of frequency 1250 Hz. What frequency will be heard by another person standing on the road (a) in front of the car (b) behind the car ? Speed of sound in air $= 340ms^{-1}$.

Watch Video Solution

58. A car moving at 108 km/h finds another car in front of it going in the same direction at 72 km/h. The first car sounds a horn that has a dominant frequency of 800 Hz. What will be the apparent frequency heard by the driver in the front car? Speed of sound in air = 330 m/s.

Watch Video Solution

59. A tuning fork of frequency 328 Hz is moved towards a wall at a speed of $2ms^{-1}$. An observer standing on the same side as the fork hears two sounds, one directly from the fork and the other reflected from the wall. How many beats per second can be heard ? (Velocity of sound in air 330 ms)

Watch Video Solution

PROBLEMS (LEVEL - II)

1. 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

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 $0.013s$?

Watch Video Solution

3. 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

4. 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

5. At t=0, transverse pulse in a wire is described by the function

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

where x and y are in metres. Write the function $y(x, t)$ that describe this plus if it is travelling in the positive x-direction with a speed of $4.50m/s$.

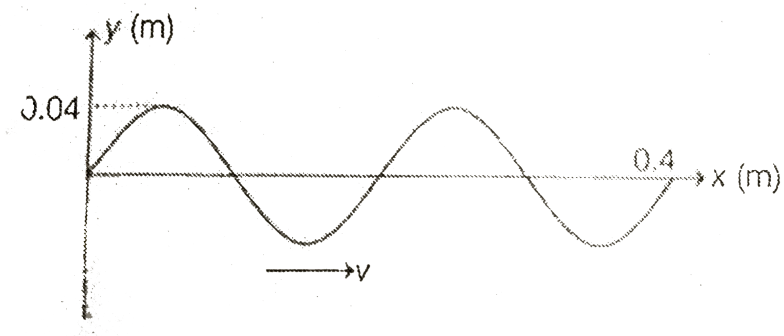
Watch Video Solution

6. A pulse travelling on a string is represented by the function $y = \frac{a^3}{(x - vt)^2 + a^2}$ where a = 5 mm and v = 20 cm/s where the maximum of pulse is located at t = 0.1s and 2s. Take x = 0 in the middle of the string

Watch Video Solution

7. 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



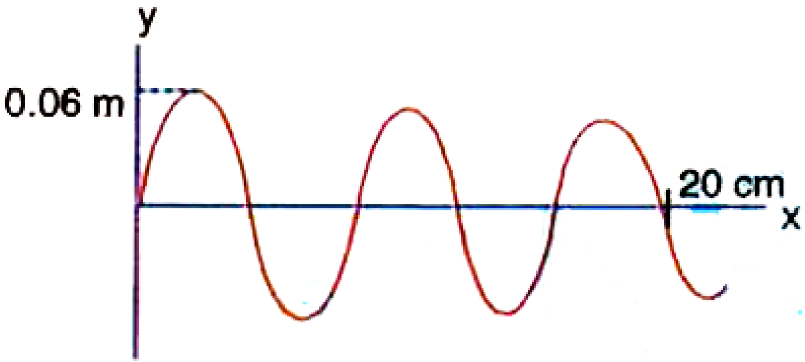
Watch Video Solution

8. 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)

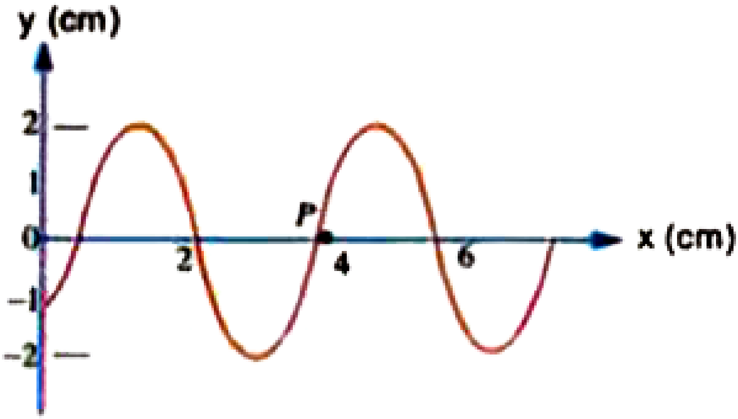
Watch Video Solution

9. For the wave shown in figure, find its amplitude, frequency and wavelength if its speed is 300 m/s. Write the equation for this wave as it travels out along the negative x-axis if its position at t = 0 is as shown



Watch Video Solution

10. Consider a sinusoidal wave travelling in positive x direction as shown in figure. The wave velocity is 40 cm/s.Find the frequency.



Watch Video Solution

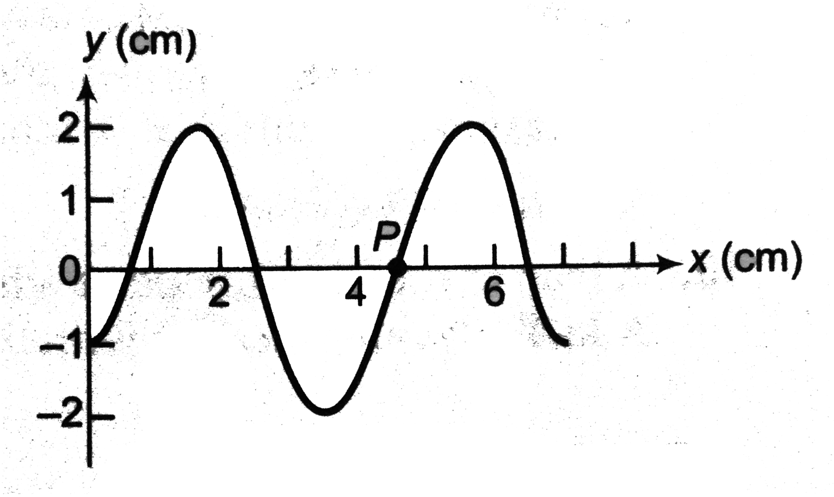
11. Consider a sinusoidal travelling wave shown in figure. The wave velocity is $+40 cm/s$.

Find

(a) the frequency

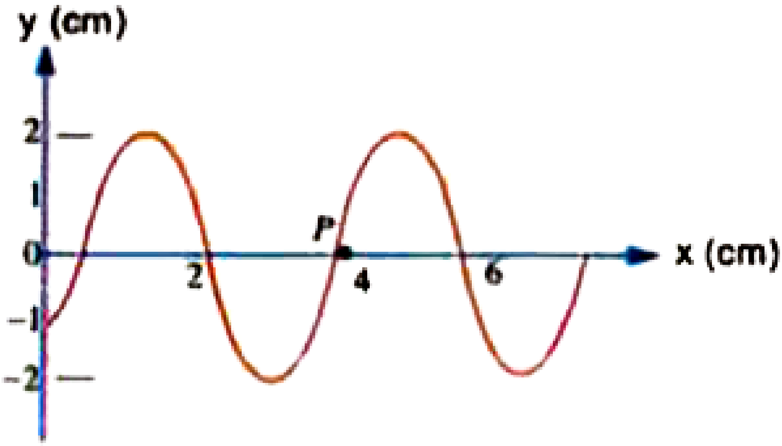
(b) the phase difference between points $2.5 cm$ apart

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



Watch Video Solution

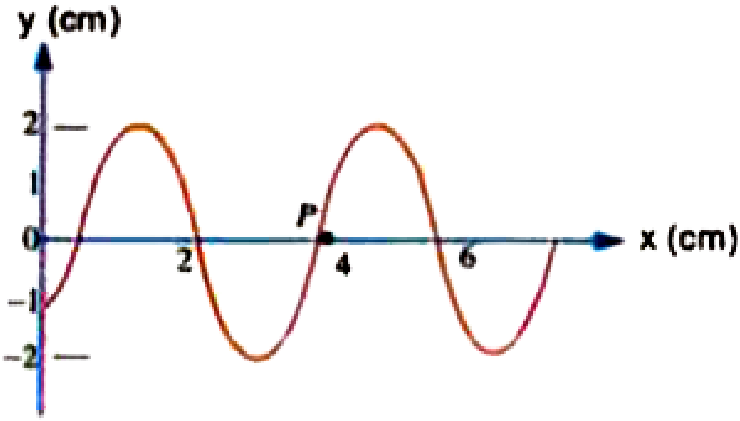
12. Consider a sinusoidal wave travelling in positive x direction as shown in figure. The wave velocity is 40 cm/s.



Find : How long it takes for the phase at a given position to change by 60°

Watch Video Solution

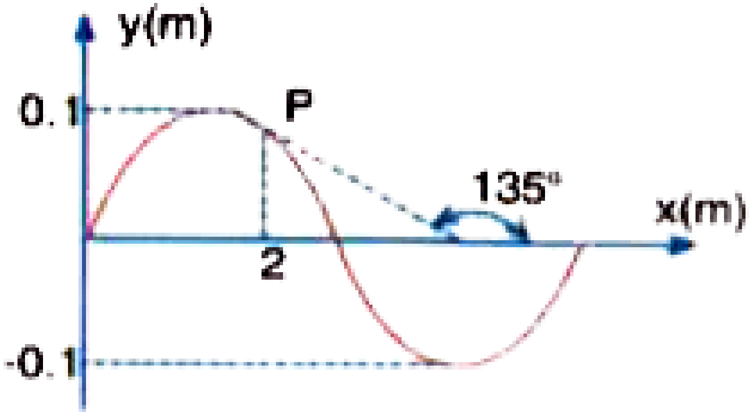
13. Consider a sinusoidal wave travelling in positive x direction as shown in figure. The wave velocity is 40 cm/s.



Find: The velocity of a particle at point P at the instant shown.

Watch Video Solution

14. A wave is travelling along a string. Its equation is given as $y = 0.1\sin 2\pi(100t + 10x)$ (All SI units) Position of different particles at some instant is shown in figure. What is velocity of particle Pat this instant?



Watch Video Solution

15. A wave propagates on a string in positive x-direction with a speed of 40 cm/s. The shape of string at t = 2 s is $y=10\frac{\cos x}{5}$ where x and y are in centimeter. The wave equation is

Watch Video Solution

16. A wave propagates in a string in the positive x-direction with velocity v. The shape of the string at $t = t_0$ is given by $f(x, t_0) = A\sin\left(\frac{x^2}{a^2}\right)$. Then the wave equation at any instant t is given by

Watch Video Solution

17. A heavy but uniform rope of lenth L is suspended from a ceiling. (a) Write the velocity of a transverse wave travelling on the string as a function of the distance from the lower end. (b) If the rope is given a sudden sideways jerk at the bottom, how long will it take for the pulse to reach teh celling ? (c) A particle is dropped from the ceiling at the instant the bottom end is given the jerk where will the particle meet the pulse ?

Watch Video Solution

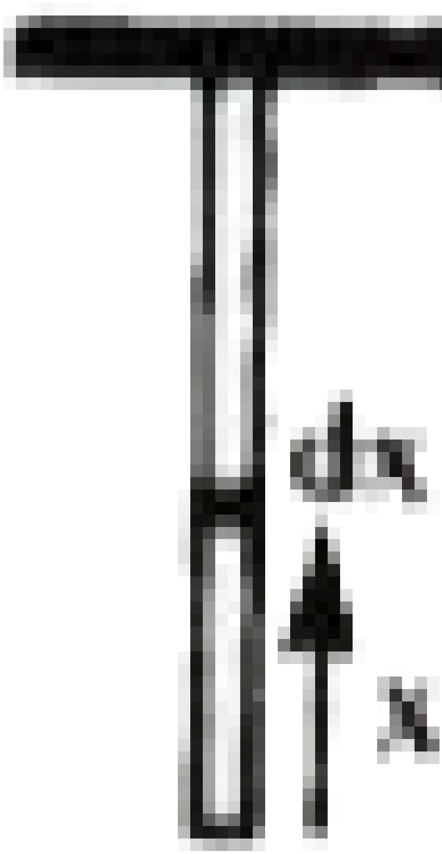
18. A heavy but uniform rope of lenth L is suspended from a ceiling. (a) Write the velocity of a transverse wave travelling on the string as a function of the distance from the lower end. (b) If the rope is given a sudden sideways jerk at the bottom, how long will it take for the pulse to reach teh celling ? (c) A particle is dropped from the ceiling at the instant the bottom end is given the jerk where will the particle meet the pulse ?

Watch Video Solution

19. 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.

Watch Video Solution

20. A wire of variable mass per unit length $\mu = \mu_0 x$, is hanging from the ceiling as shown in figure. The length of wire is l_0 . A small transverse disturbance is produced at its lower end. Find the time after which the disturbance will reach to the other ends.



Watch Video Solution

21. Three pieces of string, each of length L, are joined together end-to-end, to make a combined string of length 3L. The first piece of string has mass per unit length μ_1, the second piece has mass per unit length $\mu_2 = 4\mu_1$ and the third piece has mass per unit length $\mu_3 = \mu_1/4$.

(a) If the combined string is under tension F, how much time does it take a transverse wave to travel the entire length 3L? Give your answer in terms of L,F and μ_1.

(b) Does your answer to part (a) depend on the order in which the three piece are joined together? Explain.

Watch Video Solution

22. Three pieces of string, each of length L, are joined together end-to-end, to make a combined string of length 3L. The first piece of string has mass per unit length μ_1, the second piece has mass per unit length $\mu_2 = 4\mu_1$ and the third piece has mass per unit length $\mu_3 = \mu_1/4$.

(a) If the combined string is under tension F, how much time does it take a transverse wave to travel the entire length 3L? Give your answer in terms of L,F and μ_1 .

(b) Does your answer to part (a) depend on the order in which the three piece are joined together? Explain.

Watch Video Solution

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

Watch Video Solution

24. A transverse wave of amplitude 0.50 mm and frequency 100 Hz is produced on a wire stretched to a tension of 100 N. If the wave speed is $100ms^{-1}$, what average power is the source transmitting to the wire ?

Watch Video Solution

25. $y_1 = 8\sin(\omega t - kx)$ and $y_2 = 6\sin(\omega t + kx)$ are two waves travelling in a string of area of cross-section s and density rho. These two waves are superimposed to produce a standing wave.

(a) Find the energy of the standing wave between two consecutive nodes.

(b) Find the total amount of energy crossing through a node per second.

Watch Video Solution

26. $y_1 = 8\sin(\omega t - kx)$ and $y_2 = 6\sin(\omega t + kx)$ are two waves travelling in a string of area of cross-section s and density rho. These two waves are superimposed to produce a standing wave.

(a) Find the energy of the standing wave between two consecutive nodes.

(b) Find the total amount of energy crossing through a node per second.

Watch Video Solution

27. In a stationary wave that forms as a result of reflection of waves from an obstacle, the ratio of the amplitude at an antinode to the amplitude at node is 6. What percentage of energy is transmitted?

Watch Video Solution

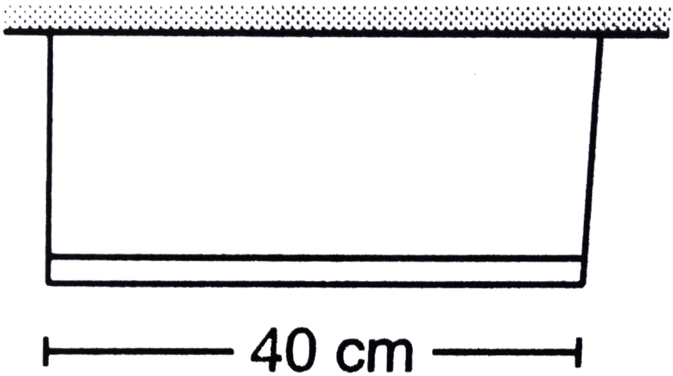
28. In a stationary wave that forms as a result of reflection of wave from an obstacle, the ratio of this amplitude at an antinode to the amplitude at anode is n. The ratio of energy reflected to energy incident is

Watch Video Solution

29. 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.

Watch Video Solution

30. A uniform horizontal rod of length 40 cm and mass 1.2 kg is supported by two identical wires as shown in figure. Where should a mass of 4.8 kg be placed on the rod so that the same tuning fork may excite the wire on left into its fundamental vibrations and that on right into its first overtone ? Take $g = 10 ms^{-2}$

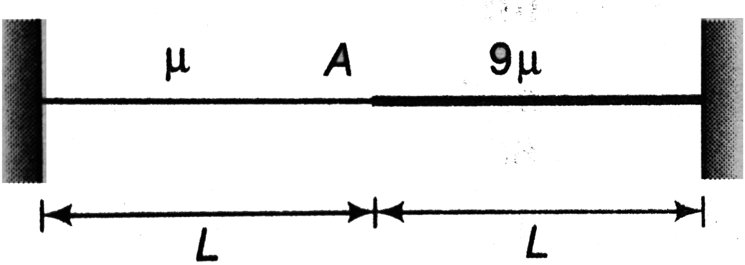


Watch Video Solution

31. 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?

Watch Video Solution

32. A light string is tied at one end to fixed support and to a heavy string of equal length L at the other end as shown in figure. Mass per unit length of the strings are μ and 9μ and the tension is T. Find the possible values of frequencies such that point A is a node/ antinode.



Watch Video Solution

33. 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 $1.5kg/m^3$

Watch Video Solution

34. Calculate the bulk modulus of air from the following data about a sound wave of wavelength 35 cm travelling in air. The pressure at a point varies between $\left(1.0 \times 10^{5} \pm 14\right)$ Pa and the particles of the air vibrate in simple harmonic motion of amplitude $5.5 \times 10^{-6} m$.

Watch Video Solution

35. The pressure variation in a sound wave in air is given by

$\Delta p = 12\sin(8.18X - 2700t + \pi/4) N/m^2$

find the displacement amplitude. Density of air $= 1.29 kg/m^3$.

Watch Video Solution

36. A point sound source is situated in a medium of bulk modulus $1.6 \times 10^5 N/m^2$. An observer standing at a distance $10m$from the source writes down the equation for the wave as $y = A\sin(15\pi x - 6000\pi t)$. Here y and x are in meter and t is in second. The maximum pressure amplitude received to the observer's ear is (24π) pa, then find.

(a) the density of the medium,

(b) the displacement ampulitude A of the wave recived by the observer

and

(c) the power of the sound source.

Watch Video Solution

37. A point sound source is situated in a medium of bulk modulus $1.6 \times 10^5 N/m^2$. An observer standing at a distance $10m$from the source writes down the equation for the wave as $y = A\sin(15\pi x - 6000\pi t)$. Here y and x are in meter and t is in second. The maximum pressure amplitude received to the observer's ear is (24π) pa, then find.

(a) the density of the medium,

(b) the displacement ampulitude A of the wave recived by the observer

and

(c) the power of the sound source.

Watch Video Solution

Watch Video Solution

38. A point sound source is situated in a medium of bulk modulus $1.6 \times 10^5 N/m^2$. An observer standing at a distance $10m$from the source writes down the equation for the wave as $y = A\sin(15\pi x - 6000\pi t)$. Here y and x are in meter and t is in second. The maximum pressure amplitude received to the observer's ear is (24π) pa, then find.

(a) the density of the medium,

(b) the displacement ampulitude A of the wave recived by the observer and

(c) the power of the sound source.

Watch Video Solution

39. A tuning fork of frequency 440 Hz is attached to a long string of linear mass density $0.01kgm^{-1}$ kept under a tension of 49 N. The fork produces transverse waves of amplitude 0.50 mm on the string. (a)

Find the wave speed and the wavelength of the waves. (b) Find the maximum speed and acceleration of a particle of the string. (c) At what average rate is the tuning fork transmitting energy to the string ?

Watch Video Solution

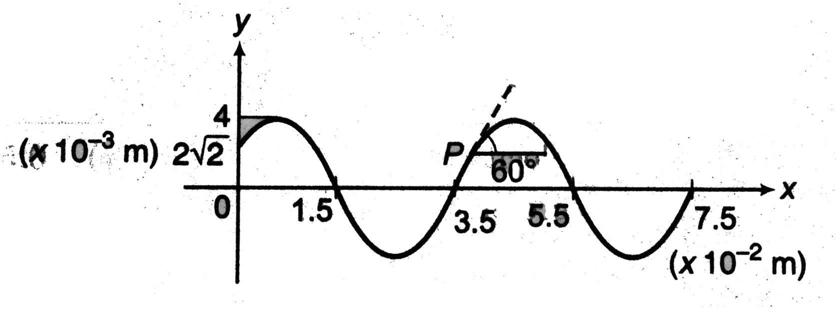
40. A tuning fork of frequency 440 Hz is attached to a long string of linear mass density $0.01 kgm^{-1}$ kept under a tension of 49 N. The fork produces transverse waves of amplitude 0.50 mm on the string. (a) Find the wave speed and the wavelength of the waves. (b) Find the maximum speed and acceleration of a particle of the string. (c) At what average rate is the tuning fork transmitting energy to the string ?

Watch Video Solution

41. A tuning fork of frequency 440 Hz is attached to a long string of linear mass density $0.01 kgm^{-1}$ kept under a tension of 49 N. The fork produces transverse waves of amplitude 0.50 mm on the string. (a) Find the wave speed and the wavelength of the waves. (b) Find the maximum speed and acceleration of a particle of the string. (c) At what average rate is the tuning fork transmitting energy to the string ?

Watch Video Solution

42. 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.

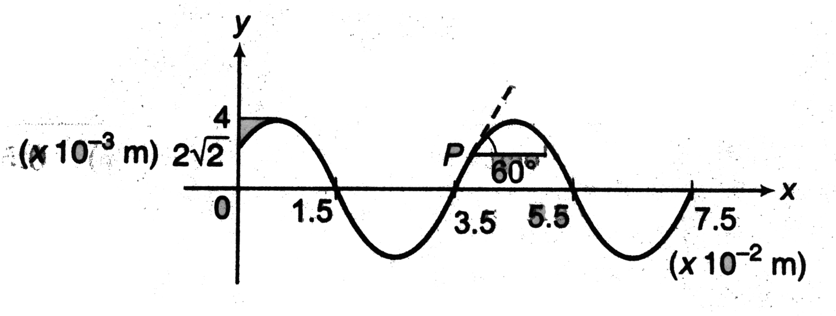
(b) Write the equation of the wave.

(c) The total energy carries by the wave per cycle of the string.

Assuming that the mass per unit length of the string is $50 g/m$.

Watch Video Solution

43. 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.

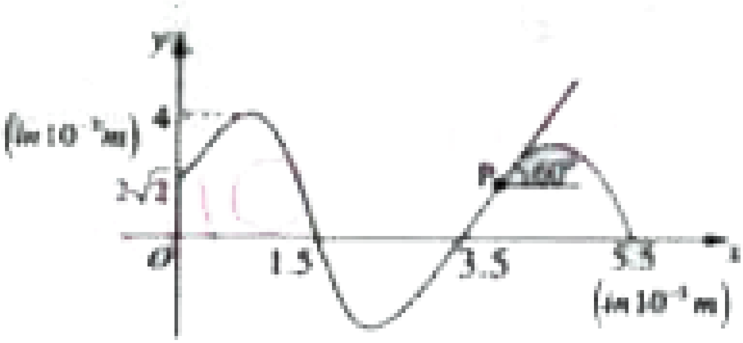
(b) Write the equation of the wave.

(c) The total energy carries by the wave per cycle of the string.

Assuming that the mass per unit length of the string is $50 g/m$.

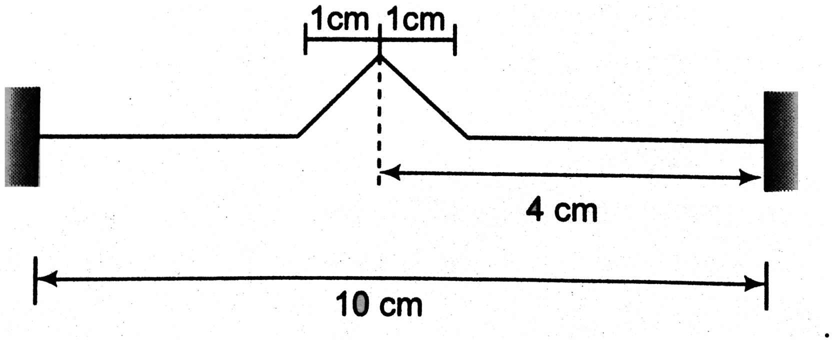
Watch Video Solution

44. The figure shows a snap photogaraph of a vibrating string at t = 0. The particle P is observed moving up with velocity $2\sqrt{3}$ cm/s. The tangent at P makes an angle 60° with x-axis. The mass per unit length of string is 50 g/m



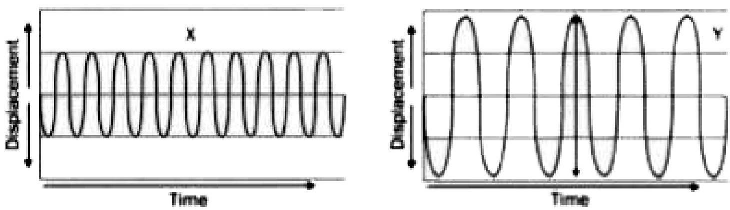
Watch Video Solution

45. A string that is 10 cm long is fixed at both ends. At t=0, a pulse travelling from left to right at $1 cm/s$ is 4.0 cm from the right end as shown in figure. Determine the next two times when the pulse will be at that point again. State in each case whether the pulse is upright or inverted .



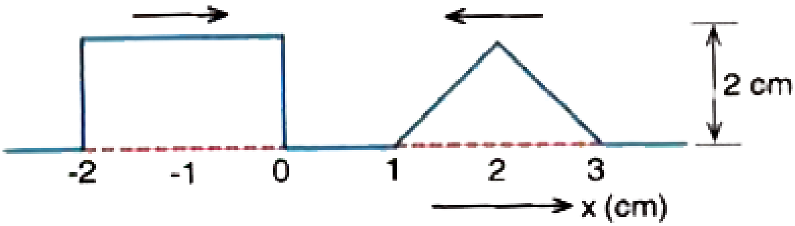
Watch Video Solution

46. Look at the figure given and identify which sound wave is louder, X or Y?



Watch Video Solution

47. Figure shows a rectangular pulse and triangular pulse approaching each other. The pulse speed is 0.5 cm/s. Sketch the resultant pulse at t = 2s.



Watch Video Solution

48. Two wires of different densities are soldered together end to end then stretched under tension T. The waves speed in the first wire is twice that in the second wire.

(a) If the amplitude of incident wave is A, what are amplitudes of reflected and transmitted waves?

(b) Assuming no energy loss in the wire, find the fraction of the incident power that is reflected at the junction and fraction of the same that is transmitted.

Watch Video Solution

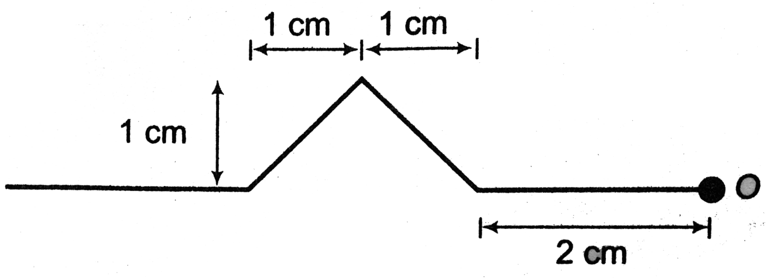
49. Two wires of different densities are soldered together end to end then stretched under tension T. The waves speed in the first wire is twice that in the second wire.

(a) If the amplitude of incident wave is A, what are amplitudes of reflected and transmitted waves?

(b) Assuming no energy loss in the wire, find the fraction of the incident power that is reflected at the junction and fraction of the same that is transmitted.

Watch Video Solution

50. A wave pulse on a string has the dimensions shown in figure. The wave speed is $v = 1cm/s$.



(a) If point O is a fixed end, draw the resultant wave on the string at t=3 s and t=4 s.

(b) Repeat part (a) for the case in which O is a free end.

Watch Video Solution

51. A wave $y_i = 0.3\cos(2.0x - 40t)$ is travelling along a string toward a boundary at x=0. Write expressions for the reflected waves if .

(a) the string has a fixed end at x=0 and

(b) The string has a free end at x=0.

Assume SI units.

Watch Video Solution

52. A wave $y_i = 0.3\cos(2.0x - 40t)$ is travelling along a string toward a boundary at x=0. Write expressions for the reflected waves if .

(a) the string has a fixed end at x=0 and

(b) The string has a free end at x=0.

Assume SI units.

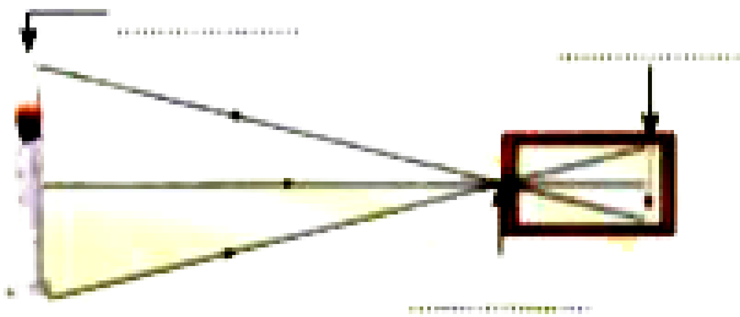
Watch Video Solution

53. The harmonic wave $y_i = \left(2.0 \times 10^{-3}\right)\cos\pi(2.0x - 50t)$ travels along a string towards a boundary at x=0 with a second string. The wave speed on the second string is $50m/s$. Write expressions for reflected and transmitted waves. Assume SI units.

Watch Video Solution

54. Three source of sound S_1, S_2 and S_3 of equal intensity are placed in a straight line with $S_1S_2 = S_2S_3$ At a point P, far away from the sources, the waye coming from S_2, is 120° ahead in phase of that from S_1. Also, the wave coming from S_3 is 120° a head of that from S_2. What would be the resultant intensity of sound at P?

Watch Video Solution



55.

Label the figure.

Watch Video Solution

56. Two audio speakers are kept some distanace apart and are driven by the same amplifier system. A person is sitting at a place 6.0 m from one of the speakers and 6.4 m from the other. If the sound signal is continuously varied from 500 Hz to 5000 Hz, what are the frequencies for which there is a destructive interference at the place of the listener ? Speed of sound in air $= 320m/s$.

Watch Video Solution

57. Two loudspeakers radiate in phase at $170H_Z$. An observer sits at $8m$ from one speaker and $11m$ from the other . The intensity level from either speaker acting alone is $60dB$. The speed of sound is $340m/s$. Find the observer intensity when both speakers are on together.

Watch Video Solution

58. Two loudspeakers radiate in phase at $170H_Z$. An observer sits at $8m$ from one speaker and $11m$ from the other . The intensity level from either speaker acting alone is $60dB$. The speed of sound is $340m/s$. Find the observer intensity when both speakers are on together.

Watch Video Solution

59. Two loudspeakers radiate in phase at $170H_Z$. An observer sits at $8m$ from one speaker and $11m$ from the other . The intensity level from either speaker acting alone is $60dB$. The speed of sound is $340m/s$. Find the observer intensity when both speakers are on together.

Watch Video Solution

60. In a resonance tube experiment to determine the speed of sound in air, a pipe of diameter $5cm$ is used . The column in pipe resonates with a tuning fork of frequency $480H_Z$ when the minimum length of the air column is $16cm$. Find the speed in air column at room temperature.

Watch Video Solution

61. In a resonance column experiment, a tuning fork of frequency 400 Hz is used. The first resonance is observed when the air column has a length of 20.0 cm and the second resonance is observed when the air column has a length of 62.0 cm. (a) Find the speed of sound in air.(b) How much distance above the open end does the pressure node form ?

Watch Video Solution

62. In a resonance column experiment, a tuning fork of frequency 400 Hz is used. The first resonance is observed when the air column has a length of 20.0 cm and the second resonance is observed when the air column has a length of 62.0 cm. (a) Find the speed of sound in air.(b) How much distance above the open end does the pressure node form ?

Watch Video Solution

63. A small source of sound oscillates in simple harmonic motion with an amplitude of 17 cm. A detector is placed along the line of motion of the source. The source emits a sound of frequency 800 Hz which travels at a speed of 340 m/s. If the width of the frequency band detected by the detector is 8 Hz, find the time period of the source.

Watch Video Solution

64. A boy riding on his bike is going towards east at a speed of $4\sqrt{2}$ m/s. At a certain point he produces a sound pulse of frequency 1650 Hz that travels in air at a speed of 334 m/s. A second boy stands on the

ground 45° south of east from him. Find the frequency of the pulse as received by the second boy.

Watch Video Solution

65. A source emitting sound at frequency 4000 Hz, is moving along the Y-axis with a speed of 22 m/s. A listener is situated on the ground at the position (660 m, 0). Find the frequency of the sound received by the listener at the instant the source crosses the origin. Speed of sound in air = 330 m/s.

Watch Video Solution

66. A source of sound emitting a 1200 Hz note travels along a straight line at a speed of 170 m/s. A detector is placed at a distance of 200 m from the line of motion of the source.

Find the frequency of sound received by the detector at the instant when the source gets closest to it.

Watch Video Solution

67. A source of sound emitting a 1200 Hz note travels along a straight line at a speed of 170 m/s. A detector is placed at a distance of 200 m from the line of motion of the source.

Find the distance between the source and the detector at the instant it detects the frequency 1200 Hz. Velocity of sound in air = 340 m/s.

Watch Video Solution

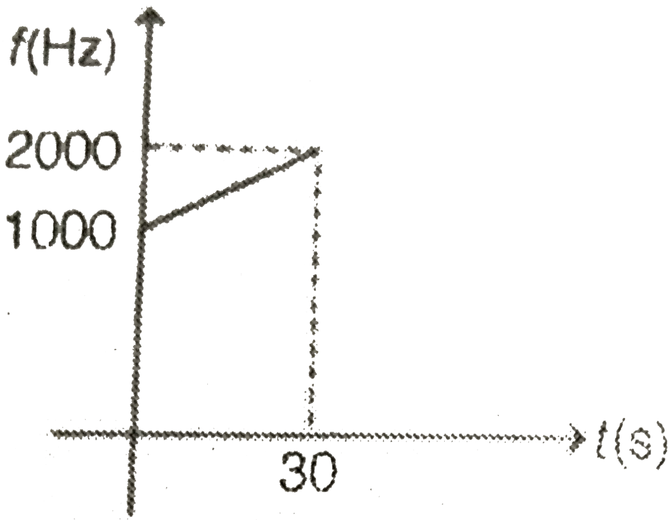
68. A source emitting a sound of frequency f is placed at a large distance from an observer. The source starts moving towards the observer with a uniform acceleration a. Find the frequency heard by the observer corresponding to the wave emitted just after the source starts. The speed of sound in the medium is v.

Watch Video Solution

69. A whistle of frequency f_0 = 1300 Hz is dropped from a height H = 505 m above the ground. At the same time, a detector is projected upwards with velocity $v = 50ms^{-1}$ along the same line. If the velocity of sound is $c = 300ms^{-1}$ find the frequency detected by the detector after t = 5s.

Watch Video Solution

70. 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 $\left(g = 10m/s^2\right)$



Watch Video Solution

71. A source S of acoustic wave of the frequency $v_0 = 1700Hz$ and a receiver R are located at the same point. At the instant $t = 0$, the source start from rest to move away from the receiver with a constant acceleration ω. The velocity of sound in air is $v = 340\frac{m}{s}$.

Q. If $\omega = 10\frac{m}{s^2}$, the apparent frequency that will be recorded by the stationary receiver at $t = 10s$ will be

Watch Video Solution

72. A sound source moves with a speed of $80m/s$ relative to still air toward a stationary listener. The frequency of sound is $200H_Z$ and speed of sound in air is $340m/s$. (a) Find the wavelength of the sound between the source and the listener. (b) Find the frequency heard by the listener.

Watch Video Solution

73. A sound source moves with a speed of $80m/s$ relative to still air toward a stationary listener. The frequency of sound is $200H_Z$ and speed of sound in air is $340m/s$. (a) Find the wavelength of the sound between the source and the listener. (b) Find the frequency heard by the listener.

Watch Video Solution

74. A railroad train is travelling at $30m/s$ in still air. The frequency of the note emitted by the node emitted by the locomotive whistle is $500H_Z$. What is the wavelength of the sound waves : (a) in front of the locomotive?

What is the frequency of the sound heard by a stationary listener (b) behind the locomotive? (c) in front of the locomotive ?

Speed of sound in air $344m/s$. (d) behind the locomotive ?

Watch Video Solution

75. A railroad train is travelling at $30m/s$ in still air. The frequency of the note emitted by the node emitted by the locomotive whistle is $500H_Z$. What is the wavelength of the sound waves : (a) in front of the locomotive?

What is the frequency of the sound heard by a stationary listener (b) behind the locomotive? (c) in front of the locomotive ?

Speed of sound in air $344m/s$. (d) behind the locomotive ?

Watch Video Solution

76. A railroad train is travelling at $30m/s$ in still air. The frequency of the note emitted by the node emitted by the locomotive whistle is $500H_Z$. What is the wavelength of the sound waves : (a) in front of the locomotive?

What is the frequency of the sound heard by a stationary listener (b) behind the locomotive? (c) in front of the locomotive ?

Speed of sound in air $344m/s$. (d) behind the locomotive ?

Watch Video Solution

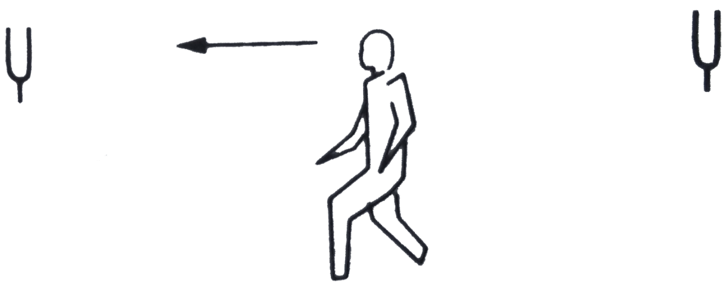
77. A railroad train is travelling at $30m/s$ in still air. The frequency of the note emitted by the node emitted by the locomotive whistle is $500H_Z$. What is the wavelength of the sound waves : (a) in front of the locomotive?

What is the frequency of the sound heard by a stationary listener (b) behind the locomotive? (c) in front of the locomotive ?

Speed of sound in air $344 m/s$. (d) behind the locomotive ?

Watch Video Solution

78. Two identical tuning forks vibrating at the same frequency 256 Hz are kept fixed at some distance apart. A listener runs between the forks at a speed of $3.0 ms^{-1}$ so that he approaches one tuning-fork and recedes from the other. find the beat frequency observed by the listener. Speed of sound in air $= 332 ms^{-1}$.



Watch Video Solution

79. 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 $v_2 < < v$

Watch Video Solution

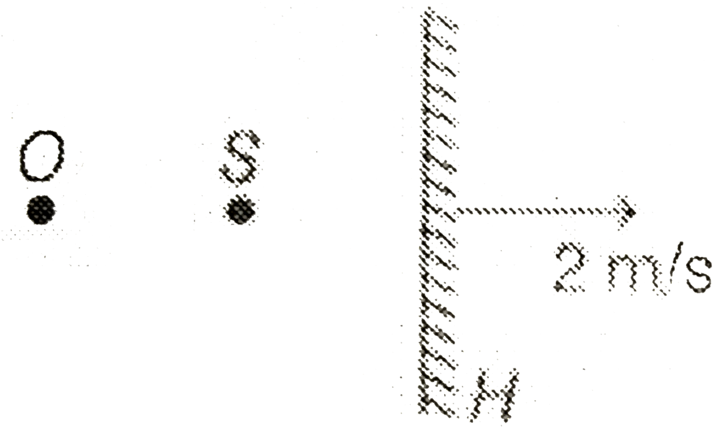
80. A 300 Hz source, an observer and wind are moving as shown in the figure with respect to the ground. What frequency is heard by the observer?

Watch Video Solution

81. A person standing on a road sends a sound signal to the driver of a car going away from him at a speed of 72 km/h. The signal travelling at 330 m/s in air and having a frequency of 1600 Hz gets reflected from the body of the car and returns. Find the frequency of the reflected signal as heard by the person.

Watch Video Solution

82. 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



Watch Video Solution

83. 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?

Watch Video Solution

84. The intensity of sound from a point source is $1.0 \times 10^{-8}Wm^{-2}$, at a distance of 5.0 m from the source. What will be the intensity at a distance of 25 m from the source ?

Watch Video Solution

85. Most people interpret a $9.0dB$ increase in sound intensity level as a doubling in loudness. By what factor must the sound intensity be increase to double the loudness?

Watch Video Solution

86. About how many times more intense will the normal ear perceiver a sound of $10^6 W/m^2$ than one of $10^9 W/m^2$?

Watch Video Solution

87. The explosion of a fire cracker in the air at the a heigth of $40m$ produced a $100dB$ sound level at ground below. What is the instantaneous total radiated power? Assuming that it radiates as a point source.

Watch Video Solution

88. The sound level at a point 5.0 m away from a point source is 40 dB. What will be the level at a point 50 m away from the source ?

Watch Video Solution

89. If the intensity of sound is doubled, by how many decibels does the sound level increase ?

Watch Video Solution

90. Sound with intensity larger than 120 dB appears painful to a person. A small speaker delivers 2.0 W of audio output. How close can the person get to the speaker without hurting his ears ?

Watch Video Solution

91. Two waves, each having a frequency of 100 Hz and a wavelength of 2.0 cm, are travelling in the same direction on a string. What is the phase difference between the waves if the second wave was produced 0.015 s later than the first one at the same place,

Watch Video Solution

92. Two waves, each having a frequency of 100 Hz and a wavelength of 2.0 cm, are travelling in the same direction on a string. What is the phase difference between the waves if the second wave was produced 0.015 s later than the first one at the same place,

Watch Video Solution

93. Two waves, each having a frequency of 100 Hz and a wavelength of 2.0 cm, are travelling in the same direction on a string. What is the phase difference between the waves if the second wave was produced 0.015 s later than the first one at the same place,

Watch Video Solution

94. Three component sinusoidal waves progressing in the same directions along the same path have the same period but their amplitudes are $A, \frac{A}{2}$ and $\frac{A}{3}$. The phases of the variation at any position x on their path at time $t = 0 are 0, -\frac{\pi}{2}$ and $-\pi$ respectively. Find the amplitude and phase of the resultant wave.

Watch Video Solution

95. A soldier walks towards a high wall taking 120 steps per minute. When he is at a distance of 90 m from the wall he observes that echo of step coincides with the next step. The speed of sound must be

Watch Video Solution

96. A man stands before a large wall at a distance of 50.0m and claps his hands at regular intervals. Initially, the interval is large. He gradually reduces the interval and fixes it at a value when the echo of a clap merges with the next clap. If he has to clap 10 times during every 3 seconds, find the velocity of sound in air.

Watch Video Solution

97. A road runs midway between two parallel rows of buildings. A motorist moving with a speed of 36 Km/h sounds the horn. He hears the echo one second after he has sounded the horn: Then the distance between the two rows of buildings is. (Velocity of sound in air is 330 m/s)

Watch Video Solution