PHYSICS

BOOKS - CENGAGE PHYSICS (ENGLISH)

TRAVELLING WAVES

Illustration

1. A sinusoida wave is travelling along a rope. The oscillator that generates wave completes 40.0 vibration in 30.0 s. also, a given 'maximum' travels 425 cm along the rope in 10.0 s. what is the wavelength of the wave ?

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2. A wave pulse is travelling along +x direction on a string at $2m/s$. Displacement y (in cm) of the parrticle at x=0 at any time t is given by $2/\left(t^2+1\right)$. Find

(i) expression of the function y=(x,t),i.e., displacement of a particle at position x and time t.

Draw the shape of the pulse at t=0 and t=1 s.

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3. A pulse moving to the right along the x-axis is represented by the wave function

where x and y are measured in cedntimetres and t is measured in seconds. Find expression for the wave function at $t=0, t=1.0s,$ and $t=2.0s$ and plote the shape of pulse at these lines.

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4. 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 $4.50 m / s$.

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5. A wave is travelling along X-axit. The disturbance at x=0 and t=0 is $A/2$ and is increasing. Where A is amplitute of the wave. If $y = A \sin(kx - \omega t + \emptyset)$, deetemine the initial phase $empyset$.

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6. A wave travelling along X-axis is given by

$y = 2(mm)\sin(3t - 6x + \pi/4)$

where x is in centimetres and t in second. Write the phases and, hence, the find the phase difference between them at t=0 for two points on X-axis, $x = x_1 = \pi/3$ cm and $x = x_2 = \pi/2$ cm.

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7. Two sinusoidal waves in a string are defined by the function $y_1 = (2.00cm)\sin(20.0x - 32.0t)$ and $y_2 = (2.00cm)\sin(25.0x - 40.0t)$ where y_1, y_2 and x are in centimetres and t is in seconds.

(a). What is the phase difference between these two waves at the point $x = 5.00cm$ at $t = 2.00s$?

(b) what is the positive x value closest to the original for which the two phase differ by $+_{\pi} att = 2.00s$? (That os a location where the two waves add to zero.)

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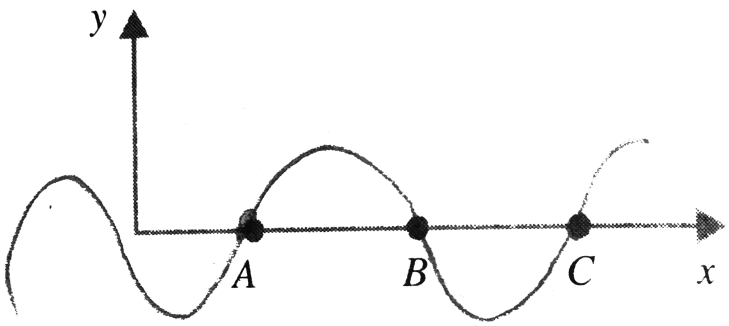
8. A,B and C are the three particles of a medium which are equally sparated and lie along the x-axis. When a sinusoidal transverse wave of wavelength k propagates along the x-axix, the following observation are made:

(i) A and B have the same speed. (ii) A and C have the same velocity.

Find (a) the minium distance between A and B and (b) the

minimum distance between A and C.



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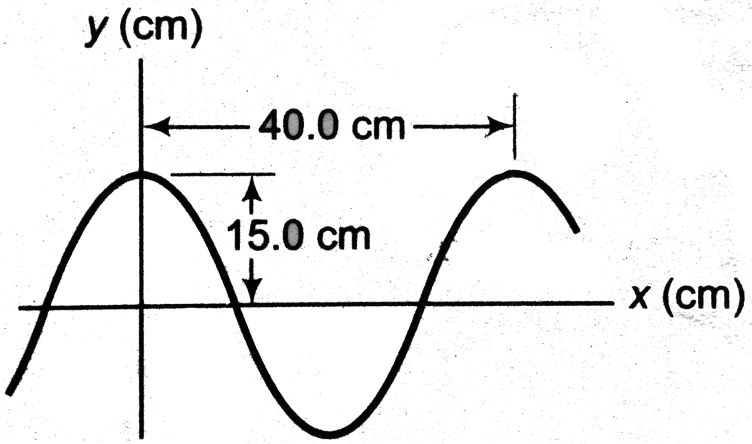
9. A sinusoidal wave travelling in the positive x-direction has an amplitude of $15.0cm$, a wavelength of $40.0cm$ and a frequency of `8.00 Hz. The vertical displacement of medium at t=0 and x=0 is also 15 cm as shown in figure.



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

(b) Write a general expression for wave function.

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10. A wave is describe by $y = (2.00cm)\sin(ks - \omega t)$, where `k=2.11 rad//m, omega =3.62 rad//s, x is in metres, and t is in seconds. Determine the amplitude, wavelength, frequency, and speed of the wave.

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11. If the displacement relation for a particle in a wave is given by $y = 5\sin\left(\frac{t}{0.04} - \frac{x}{4}\right)$, determine the maximum speed of the particle in SI units.

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12. Verify that wave function

$$\left(y = \frac{2}{(x - 3t)^2} + 1\right)$$

is a solution to the linear wave equation, x and y are in centimetres.

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13. The wave function for a travelling wave on a taut string is

$y(x, t) = (0.350m)\sin(10\pi t - 3\pi x + \pi/4)$. (SI units)

(a) what is the speed and direction of travel of the wave ?

(b) what if the verticaly position of an element of the string at $t = 0, x = 0.100m$?

(c) what is the wavelength and frequency of the wave?

(d) waht is the maximum transverse speed of an element of the string?

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14. (a) writ the expression for y as a function of x and t for a sinusoidal wave travelling along a rope in the neagative x direction with the folllowing characteristics: A =8.00 cm ,

$\delta = 80.0cm$, $f = 3.00Hz$, and $y(0, t) = 0att = 0$, (b) write an expression for y as a function of x and t for the wave in part (a) assuming that y(x,0)=0 at the point x=10.0 cm.

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15. Given the equetion for a wave on a string

$y = 0.03 \sin(3x - 2t)$

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

(a). At t=0, what are the values of the displacement at x=0,0.1 m,0.2 m, and 0.3m ?

(b). At x=0.1 m what are the values of the displacement at t=0,0.1 s, and 0.2 s?

(c) what is the equetion for the velocity of oscillation of the particles of the string?

(d). what is the maximum velocity of oscillation?

(e). what is the velocity of propagation of the wave?

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16. A plane progressive wave is give by $x = (40cm)\cos(50\pi t - 0.02\pi y)$ where y is in centimetres and t in seconds. What will be the particle velocity at $y = 25cm$in timet=1//200 s?

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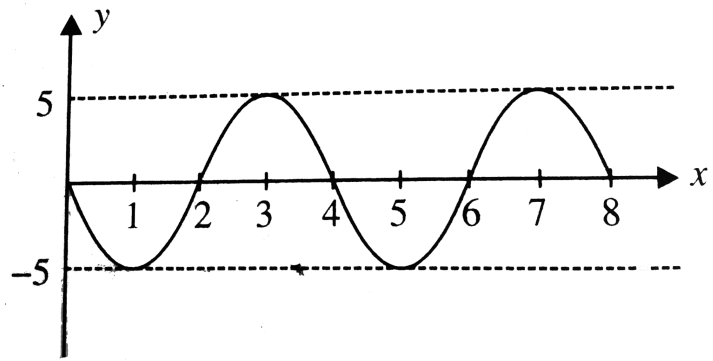
17. Shows the shape of a progressive wave at time $t = 0$. after a time $t = (1)/(80)$, the particle at the origin has its maximum negative displacement.if the wave speed is 80

units maximum negative displacement. If the wave speed is 80 units, then find the equation of the progressive wave.



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18. A taut string having tension 100 N and linear mass density $0.25kg/m$ is used inside a cart to generate a wave pulse starting at the left end, as shown. What should be the velocity of the cart so that pulse remains stationary w.r.t. ground.

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19. Transverse waves travel with a speed of $20.0 m / s$ in a string under a tension of 6.00 N. what tension is requared for a wave speed of $30.0 m / s$ in the same string?

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20. An 80.0 kg hiker is trapped on a mountain ledge following a storm. A helicoptar rescuse the hiker by hovering above him and lowering a cable to him. The mass of the cable is 8.00 kg, and its length is 15.0 m. A sling of mass 70.0 kg is attached to the end of the cable. the hiker attaches himself to the sling, and the helicopter then accelerates upward. terrified by hanging from the cable in midair, the hiker tries to singnal the pilot by sending

transverse pulses up the cable. a pulse takes 0.250 s to travel the length of the cable. what is the acceleration of the helicopter?

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21. A rope of total mass m and length L is suspended vertically. Show that a transverse pulse travels the length of the rope in a time interval $\Delta t = 2\sqrt{L/g}$. Sugestion: first find an expression for the wave speed at any point a distance x from the lower end by considering the rope's tension as resulting from the weight of the segment below that point.

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22. It is stated in the previous problem that a pilse travels from the bottom to the top of a hanging rope of length L in the time interval $\Delta = 2\sqrt{\frac{L}{g}}$. Use this result to answer the following question. (It is not neccesary to set up any new integrations.) (a) over what time interval does a pulse travel halfway up the rope? Give your answer as a fraction of the quantity $2\sqrt{\frac{L}{g}}$. (b) A pulse starts travelling up the rope. how far it travelled after a time interval $\frac{\sqrt{L}}{g}\Bigg)$?

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23. An aluminium wire is clamped at each end and under zero tension at room temperature. Reducing the tempreture, which results in a decrease in the wire's

equilibrium length, increase the tension in the wire. What strain $((\Delta L/L))$ rejults in a transverse wave speed of $100m/s$? Take the cross-seectional area of the wire to be $5.00 \times 10^{-6} m^2$, the density to be 2.70×10^3 kg//m^(3) , $abdyoung's \bmod \underline{u}s \to be$7.00xx10^(10)N//m^(2)`.

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24. A transverse wave of wavelength 50 cm is travelling towards+vex-axis along a string whose linear density is $0.05g/cm$. The tension in the string is 450 N. At t=0,the particle at x=0 is passing through its mean position wave. The amplitude of the wave is 2.5 cm.

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

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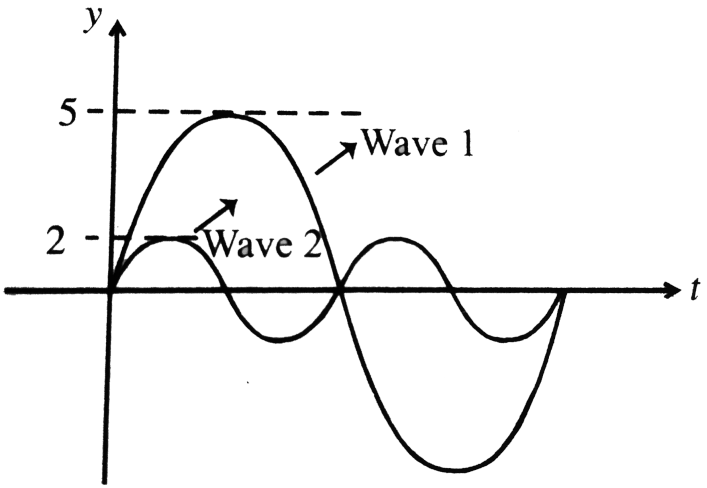
26. Two waves in the same medium are represented by y-t curves in the



. Find the ratio of their average intensities?

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27. Sinusoidal waves 5.00 cm in amplitude are to be transmitted along a string that has a linear mass density of $4.00 \times 10^{-2} kg/m$. The source can deliver a macimum power of 300 W and the string is under a tesion of 100 N. what is the highest frequancy at which the source can operate?

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28. A sinusoidal wave on a string is described by the wave function where x and y are in metres and t is in seconds. The mass per unit length of this string is $12.0 g/m$. Determine

(a) the speed of the wave, (b) the wavelength, (c) the frenquecy and (d) the power transmitted to the wave.

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Example

1. A transverse mechanical harmonic wave is travellling on a string. Maximum velocity and maximum acceleration of a particle on the string are $3m/s$ and $90m/s^2$, respectively. If the wave is travelling with a speed of $20m/s$ on the string, write wave function describing the wave. \

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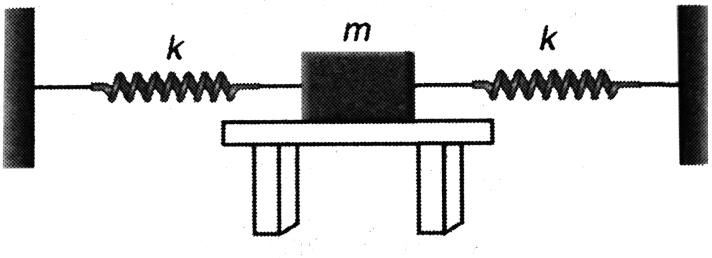
2. The equation of a travelling plane sound wave has the form $y = 60\cos(1800t - 5.3x)$, where y is in micrometres, t in seconds and x in metres. Find

(a). The ratio of the displacement amplitude with which the particle of the medium oscillate to the wavelength,

(b).the velocity oscillation ammplitude of particles of the medium and its ratio to the wave propagation velocity , (c).the oscillation amplitude of relative deformation of the medium and its relation to the velocity oscillation amplitude of particles of the medium, (d). the particle acceleration amplitude.

3. One end of each of two identical springs, each of force constant $0.5N/m$ are attached on the opposite sides the a wooden block of mass $0.01kg$. The other ends of the spring are connected to separate rigid supports such that the springs are unstrtched and are collinear in a horizontal plane. To the wooden piece is fixed a pointer which touches a vertically moving plane paper. The wooden piece kept on a smooth horizontal table is now displaced by $0.02m$ along the line of springs and released. If the speed of paper is $0.1m/s$, find the equation of the path traced by the pointer on the paper and the distance between two consecutive

maximum on this path.



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4. A wave pulse starts propagating in the +x-direction along a non-uniform wire of length 10 m with mass per unit length given by $\mu = \mu_0 + az$ 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=9xx10^(-3)kg//m^(2)).

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5. When a train of plane wave traverses a medium, individual particles execute periodic motion given by the equation

$$y4\frac{\sin(\pi)}{2}\left(2t\frac{x}{8}\right)$$

Where the length are expressed in centimetres and time in seconds. Calculate the amplitute, wavelength, (a) the phase different for two positions of the same particle which are occupied at time interval 0.4 s apart and (b) the phase difference at any given instant of two particle 12 cm apart.

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6. How long will it take sound waves to travel the distance l between the point A and B if the air temperature between

them varies linearly from $T_1 \to T_2$? The velocity of sound propagation in air is equal to $va\sqrt{T}$ where a is a constant.

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7. A wave of frequency f =1000 Hz, propagates at a velocity $v = 700m/s$ along the x-axis.

(a). What is the wavelength of the wave?

(b). Find all the points at a given time, at which the phase of the wave exceeds the phase at the origin by $\pi/3$ radian.

(c) Find the phase gained at a given point x during a time interval $\Delta t 0.5 \times 10^{-3} s$.

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8. The equation of a progressive wave is give by $y = 0.20 \sin 2\pi(60t - x/5)$ where x and y are in metres and t is in seconds. Find the phase difference (a) between two particles separted by a distance of $\Delta x = 125cm,$ and $(b) between the two \in s \tan ts$(1//120 s and 1//40 s`, for any particle.

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

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Exercise 5.1

1. Transverse waves are possible in solids but not in fluids wahy?

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2. How can one create plane waves and slpherical waves?

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3. Is an oscillation a wave? Explain.

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4. Which parts of the curve in the figure shown represent compression and rarefaction for a longitudianal wave?

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5. How would you create a longitudinal wave in a streatched spring? Would it be possible to create a transverse wave in a spring?

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6. A longitudal wave is produced on a slinky. The wave travels at a speed of 30 cm/s and the frequency of the

wave is 20 Hz. What is the minimum separation between two consecutive compression of the slinky?

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7. A narrow pulse (for example, a short pip by a whistle) is sent across a medium. If the pulse rate is 1 after every 20 s (that is the whistle is blow for a split of second after every 20 s). Is the frequency of the note produced by the whistle equal to $1/20$ or $0.05Hz$?

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8. Waves are generated on a water surface. Calculate the phase difference between two points A and B, when (i) A

and B lie on the same wavefront at a distance of 2λ between them

(ii) A and B lie on successive crests separated by 1 m

(iii) A and B lie on succesive through separated by 1.5 m

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9. Transverse waves are possible in solids but not in fluids why?

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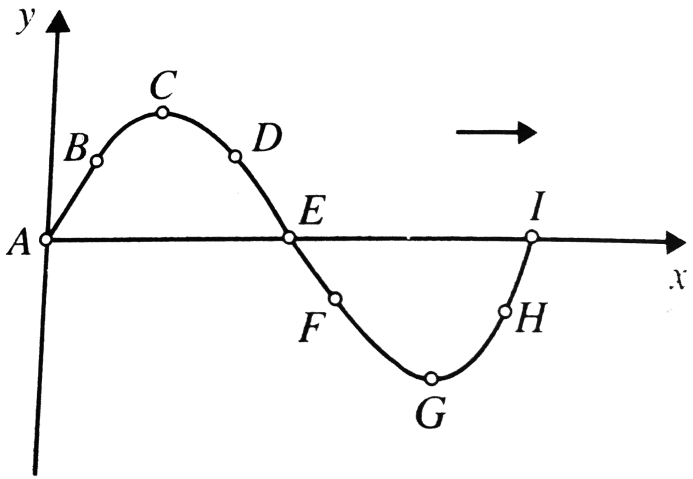
Exercise 5.2

1. A transverse wave is travelling along a string in the positive x-axis. The



shows the photograph of the wave at an instant. Find

(a) the points moving upwards

(b) the points moving downwards

(c) the points which have zero velocity

(d) the points which have maximum velocity

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2. Does the wave function $y = A_0 \cos^2(2\pi f_0 t - 2\pi x / \lambda_0$ represent a wave? If yes, the determine its amplitude frequency, and wavelength.

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3. Does the equation

$y = +\sqrt{16 - (2x - t)^2}$,

(2x-t)lt4 or (2x-t)gt-4`,

=0,otherwise

represent a wave? If yes, then find the amlityde and the phase velocity.

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4. The equation of a travelling wave is given by

$$y = +\frac{b}{a}\sqrt{a^2 - (x - ct)^2} where - a < x < a$$

=0,otherwise

Find the amplitude and the wave velocity for the wave. what is the initial particle velocity at the position $x = a/2$?

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5. Does a travelling wave in one dimension represented by a function of a linear combination of x and t,i.e., $y = f(ax \pm bt)$ represented a travelling wave?

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6. A wave is propagating on a long stretched string along its length taken as the positive x-axis. The wave equation is given as

$y = y_0 e^{-\left(\frac{t}{T} - \frac{x}{\lambda}\right)^2}$

where $y_0 = 4mm, T = 1.0s$ and $\lambda = 4cm$.(a) find the velocity of wave. (b) find the function $f(t)$ giving the displacement of particle at x=0. (c) find the function g(x) giving the shape of the string at t=0.(d) plot the shape g(x) of the string at t=0 (e) Plot of the shape of the string at t=5s.

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

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

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

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

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

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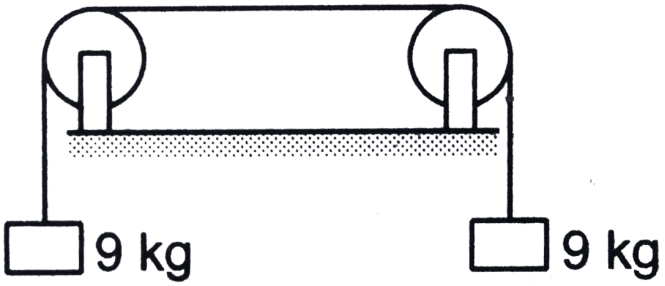
8. The length of the wire shown in figure between the pulley is 1.5 m and its mass is 12.0 g. Find the frequency of vibration with which the wire vibrates in two loops leaving

the middle point of the wire between the pulleys at rest.



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9. 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.

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10. 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.

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

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12. A wave travels out in all direction from a point source. Justify the expression $y = \left(\frac{a_0}{r}\right)\sin k(r - vt)$, at a distance r from the source. Find the speed, periodicity and intensity of the wave.what are the dimensions of a_0?

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13. For plane waves in the air of frequency 1000 Hz and the displace amplitude $2 \times 10^{-8} m$, deduc (i) the velocity amplitude, and (ii) the intensity. (Take p= 1.3 kg//m^(3),c=340 m//s)`

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14. A heavy uniform rope is held vertically and is tensioned by clamping it to a rigid support at the lower end. A wave of a certain frequency is set up at the lower end. Will the wave travel up the rope with the same speed?

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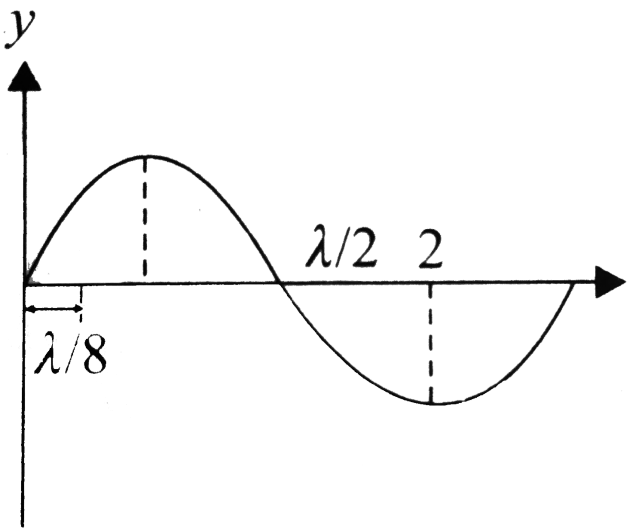
15. What is the phase diffrence between the particle 1 and 2 located as shown in



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16. Show that $(a)y = (x + vt)^2, (b)y = (x + t)^2, (c)y = (x - vt)^2,$ and (d) y=2 sin xcos vt are each a solution of one dimensional wave equation but not (e) y=x^(2)-v^(2)t^(2) and (f)y=sin 2x cos vt.`

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17. For a travelling harmonic wave $y = 2.0\cos(10t - 0.0080x + 0.35)$, where x and y are in centimetres and t in seconds. What is the phase difference between oscillatory motion of two points separated by a distance of (a) 4cm (b) 0.5 cm (c) $\lambda/2$ (d) $3\lambda/4$

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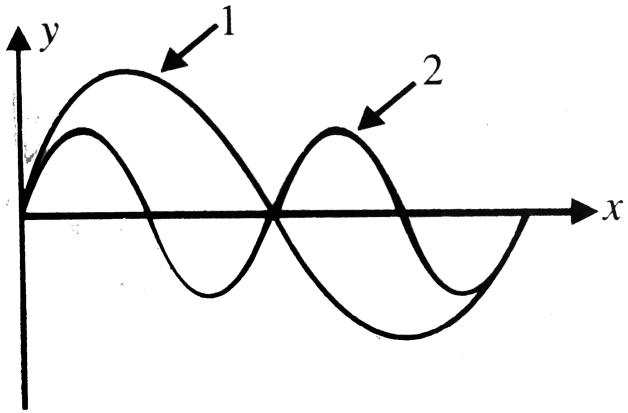
18. The



shows two snapshots, each of a wave travelling along a particular string. The phase for the waves are given by (a) 4x-8t (b) 8x-16t. Which phase corresponds to which waves in

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19. A circular loop of string rotates about its axis on a frictionless horizontal plane at a uniform rate so that the tangential speed of any particle of the string is v. if a small transvers disturbance is produced at a point of the loop,with what speed (relative to the string) will this disturbance travel on the string?

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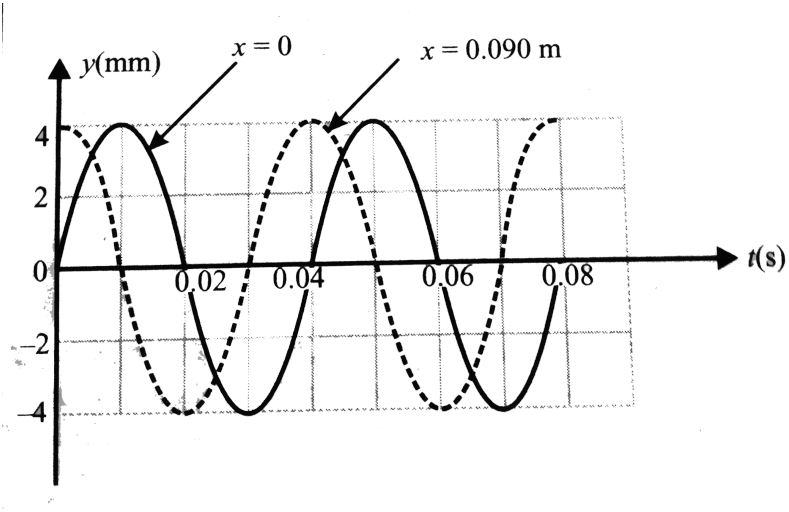
20. A sinusoidal wave is propagating along a streched string that lies along the x-axis. The displacement of the string as a function of time is graphed in for particles at x-0 and at x=0.0900 m. (a) what is the amplitude of the wave? (b)what is the period of the wave? (c) you are told that the two points 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?



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21. A simple harmonic oscillator at the point x=0 genrates a wave on a rope. The oscillator operates at a frequency of 40.0 Hz and with an amplitude of 3.00 cm. the rope has a linear mass density of $50.0g/m$ and is strectches with a tension of 5.00 N. (a) determine the speed of the wave. (b) find the wavelength. (c) write the wave function y(x,t) for the wave, Assume that the oscillator has its maximum upward displacement at time t=0. (d) find the maximum transverse acceleration at time t=0. (d) find the maximum transverse of points on the rope. (e) in the discussion of transverse waves in this chapter, the force of gravity was ignored. is that a reasonable assumption for this wave? explain.

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22. A piano wire with mass 3.00 g and length 80.0 cm is stretched with a tension of 25.0 N. A wave with frequancy 120.0 Hz and amplitude 1.6 mm travels along the wire. (a) calculate the average power carried by the wave. (b) what happenes to the avarage power if the wave amplitude is halved?

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23. 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=3pi//4k, (v)x=pi//k, (vi)x=5pi//4k, (vii) x=3pi//2k, (viii) x=7pi//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.

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Subjective

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

expression represent (s) the displacement of string as a function of x(in metre) and t (in second)

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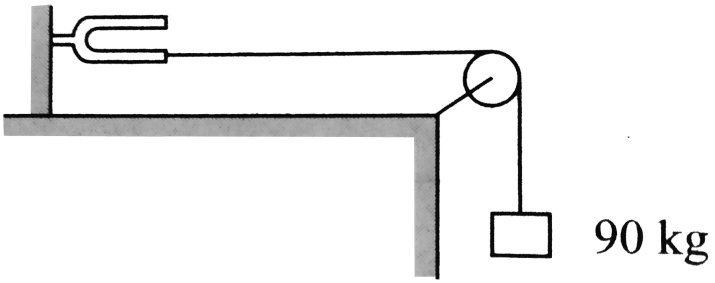
2. One end of a long string of linear mass density $10^{-2}kgm^{-1}$ is connected to an electrically driven tuning fork of frequency 150 Hz. The other end passes over a pulley and is tied to a pan containig a mass of 90 kg. the pulley end absorbs all the incoming energy so that reflected waves from this end have neglidible amplitude , At t =0, the left end (fork end) of the string is at x=0 has a transverse displacement of 2.5 cm and is moving along positive y-direction. the amplitude of the wave is 5 cm. write down the transverse displacement y (in cetimetres) as function of x(in metres) and t (in seconds) that describes the wave on the

string.



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3. An harmonic wave has been set up on a very long string which travels along the length of the string. The wave has a frequency of 50 Hz, amplitude 1 cm and wavelength 0.5 m. find

(a) the time taken by the wave to travel a distance of 8 m along the length of string (b) the time taken by a point on the string to travel a distance of 8 m, once the wave has

reached the point and sets it into motion (c) also. consider the above case when the amplitude gets doubled

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4. A harmonic wave is travelling in a stationary medium whose equation of this wave w.r.t. a frame which is moving along -ve x-axis with a constant speed v w.r.t. stationary medium. Also, find speed of wave in moving frame.

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5. A plane undamped harmonic wave progates in a medium. Find the mean space density of energy becomes equal to W_0 at an instant $t = t(0) + T/6$, where t_0 is the instant

when amplitude is maximum at this location and T is the time period of oscillation.

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6. A steel wire has a mass of $50g/m$ and is under tension 450N.

(a) Find the maximum average power that can be carried by the transverse wave in the wire if the amplitude not to exceed 20% of the wavelength. (b) The change in maximum average power if the mass per unit length of the wire is doubled. $\left(Use\pi^2 \cong 10.\right)$

Watch Video Solution

7. A wave is propagating on a long stretched string along its length taken as the positive x-axis. The wave equation is given as

$y = y_0 e^{-\left(\frac{t}{T} - \frac{x}{\lambda}\right)^2}$

where $y_0 = 4mm, T = 1.0s$ and $\lambda = 4cm$.(a) find the velocity of wave. (b) find the function $f(t)$ giving the displacement of particle at x=0. (c) find the function g(x) giving the shape of the string at t=0.(d) plot the shape g(x) of the string at t=0 (e) Plot of the shape of the string at t=5s.

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

Here, x and y are in meter and t in second. In which

direction and with what velocity is the pulse propagation. What is the ampitude of pulse?

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9. 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 $2.0ms^{-2}. Takeg = 10ms^{-2}$.

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10. The speed of a transverse wave going on a wire having a length 50 cm and maas 5.0 g is $80ms^{-1}$ The area of cross section of the wire is $1.0mm.^{2}$ and its Young modulus is $16 \times 10^{11} Nm^{-2}$. Find the extension of the wire over its natural lenth.

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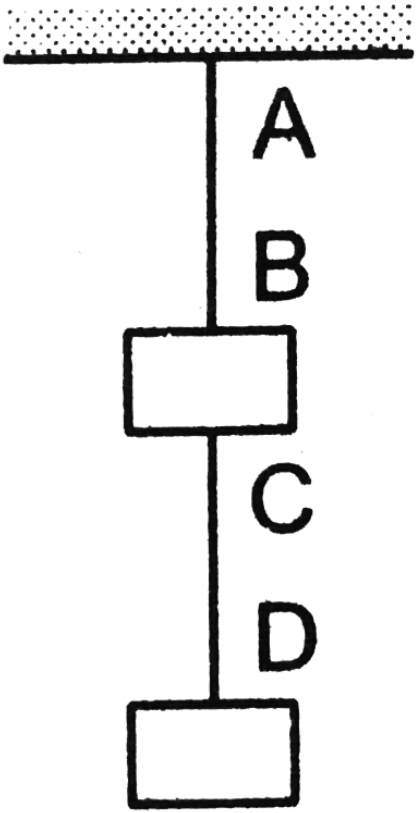
11. Two blocks each having a mass of 3.2 kg are connected by a wire CD and the system is suspended from the ceiling by another wire AB . The linear mass density of the wire AB is 10 g /m and that of CD is $8gm^{-1}$. Find the speed of a

transverse wave pulse produced in AB and in CD.



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12. A transverse harmonic wave of amplitude 0.01 m is genrated at one end (x=0) of a long horizontal string by a

tuning fork of frequency 500 Hz. At a given instant of time the displacement of the particle at x=0.1 m is -0.005 m and that of the particle at x=0.2 m is +0.005 m. calculate the wavelength and the wave velocity. obtain the equetion of the wave assuming that the wave is traveling along the + x-direction and that the end x=0 is at he equilibrium position at t=0.

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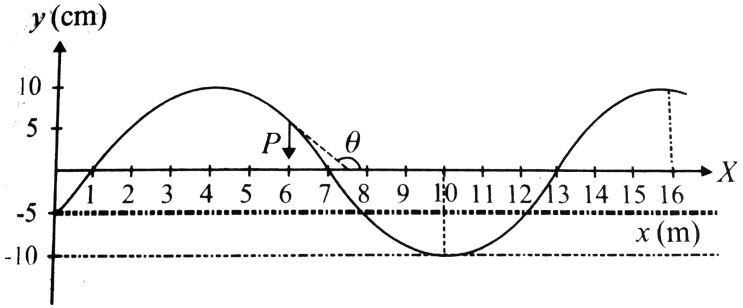
13. The given figure shows the position of a medium particle at t=0, supporting a simple harmonic wave travelling either along or opposite to the positive x-axis.



(a) write down the equation of the curve.

(b) find the angle θ made by the tangent at point P with the x-axis.

(c) If the particle at P has a velocity $v_p m/s$, in the negative y-direction, as shown in figure, then determine the speed and direction of the wave.

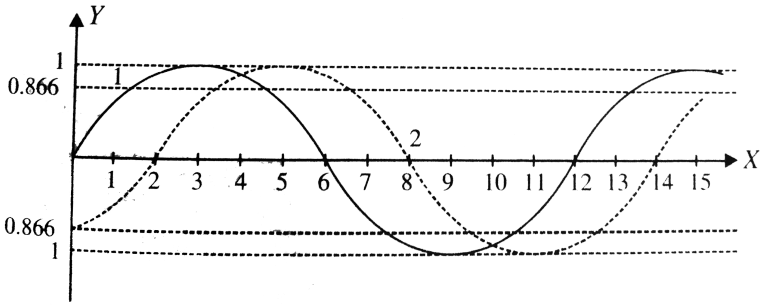
(d) find the frequency of the wave.

(e) find the displacement equation of the particle at the origin as a function of time.

(f) find the displacement equation of the wave.

Watch Video Solution

14. Figure shows two snapshots of medium particle within a time interval of $\frac{1}{60}$ s. find the possible time periods of the wave



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15. The equation of a progressive wave travelling along a string is given by

$$y = 10 \sin \pi (0.01x - 2.00t)$$

where x and y are in centimetres and t in seconds. Find the

(a) velocity of a particle at x=2 m and $t = 5/6$ s. (b) acceleration of a particle at x=1 m and $t = 1/4$ s. also find the velocity amplitude and acceleration amplitude for the wave.

Watch Video Solution

16. A travelling wave is given by

$$y = \frac{0.8}{(3x^2 + 24xt + 48t^2 + 4)}$$

where x and y are in metres and t is in seconds. Find the velocity in m/s.

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Single Correct

1. The speed of a wave in a medium is $960ms^{-1}$. If 3600 waves are passing through a point in the medium in one minute then calculate the wavelength.

A. 2m

B. 4m

C. 8m

D. 16m

Answer: D

Watch Video Solution

2. A simple harmonic progressive wave is representive by the equation $y = 8\sin 2\pi(0.1x - 2t)$ where x and y are in

centimetres and t is in seconds. At any instant the phase difference between two particle separted by 2.0 cm along the x-direction is

A. 18°

B. 36°

C. 54°

D. 72°

Answer: d

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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. $63cm/s$

B. $75cm/s$

C. $100cm/s$

D. $121cm/s$

Answer: a

Watch Video Solution

4. A wave is represented by the equetion

$$y = 7\sin\left(7\pi t - 0.04\pi x + \frac{\pi}{3}\right)$$

x is in metres and t is in seconds. The speed of the wave is

A. $175m/s$

B. $49\pi m/s$

C. $49/\pi m/s$

D. $0.28\pi m/s$

Answer: a

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5. 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

6. A transverse wave is described by the equatiion $Y = Y_0 \sin 2\pi(ft - x/\lambda)$. The maximum particle velocity is equal to four times the wave velocity if

$\lambda = \pi Y_0/4$

$\lambda = \pi Y_0/2$

$\lambda = \pi Y_0$

$\lambda = 2\pi Y_0$

A. $\lambda = \frac{\pi y_0}{4}$

B. $\lambda = \frac{\pi y_0}{2}$

C. $\lambda = \pi y_0$

D. $\lambda = 2\pi Y_0$

Answer: b

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7. The equetion of a wave travelling on a string is

$$y = 4\frac{\sin(\pi)}{2}\left(8t - \frac{x}{8}\right)$$

if x and y are in centimetres, then velocity of waves is

A. $64cm / \sin - vex - \text{direction}$

B. $32cm / \sin - vex - \text{direction}$

C. $32cm / \sin + vex - \text{direction}$

D. $64cm / \sin + vex -$ direction

Answer: d

Watch Video Solution

8. if $x = a\sin(\omega t + \pi/6)$ and $x' = a\cos\omega$, t, then what is the phase difference between the two waves

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

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

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

D. π

Answer: a

Watch Video Solution

9. A simple harmonic wave is represent by the relation

$$y(x, t) = a_0 \sin 2\pi\left(vt - \frac{x}{\lambda}\right)$$

if the maximum particle velocity is three times the wave velocity, the wavelength λ of the wave is

A. $\pi a_0 / 3$

B. $2\pi a_0 / 3$

C. πa_0

D. $\pi a_0 / 2$

Answer: b

Watch Video Solution

10. The equation of a travelling wave is

$y = 60\cos(1800t - 6x)$

where y is in microns, t in seconds and x in metres. The ratio of maximum particle velocity to velocity of wave propagation is

A. 3.6

B. 3.6×10^{-6}

C. 36×10^{-11}

D. 3.6×10^{-4}

Answer: d

Watch Video Solution

11. The equation of a progressive wave is

$$y = 0.02 \sin 2\pi \left[\frac{t}{0.01} - \frac{x}{0.30} \right]$$

here x and y are in metres and t is in seconds. The velocity of propagation of the wave is

A. $300 m / s$

B. $30 m / s$

C. $400 m / s$

D. $40 m / s$

Answer: b

Watch Video Solution

12. 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?

A. $1m/s$

B. $1.5m/s$

C. $0.5m/s$

D. $2m/s$

Answer: c

Watch Video Solution

13. In a medium in which a transverse prograssive wave is travelling, the phase difference between two points with a separation of 1.25 cm is `(pi//4). If the frequancy of wave is 1000 Hz. Its velocity will be

A. $10^4 m/s$

B. $125 m/s$

C. $100 m/s$

D. $10 m/s$

Answer: c

Watch Video Solution

14. A plane sound wave is travelling in a medium. In reference to a frame A, its equation is y=a cos $(\omega t - kx)$. Which refrence to frame B, moving with a constant velocity v in the direction of propagation of the wave, equation of the wave will be

A. $y = a\cos[\omega t + kvt - kx]$

B. $y = -a\cos[\omega t - kvt - kx]$

C. $y = a\cos[\omega t - kvt - kx]$

D. $y = a\cos[\omega t + kvt + kx]$

Answer: c

Watch Video Solution

15. Small amplitude progressive wave in a stretched string has a speed of $100cm/s$.and frequency 100 Hz. The phase difference between two points 2.75 cm apart on the string in radians, is

A. 0

B. $11\pi/2$

C. $\pi/4$

D. $3\pi/8$

Answer: B

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16. The linear density of a vibrating string is $10^{-4} kg/m$. A transverse wave is propagating on the string, which is described by the equation $y = 0.02 \sin(x + 30t)$, where x and y are in metres and time t in seconds. Then tension in the string is

A. 0.09 N

B. 0.36 N

C. 0.9 N

D. 3.6 N

Answer: a

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17. Two blocks of masses 40 kg and 20 kg are connected by a wire that has a linear mass density of $1g/m$. These blocks are being pulled across horizontal frictionless floor by horizontal force F that is applied to 20 kg block. A transverse wave travels on the wave between the blocks with a speed of $400m/s$ (relative to the wire). the lmass of the wire is negligible compared to the mass of the blocks. the magnitude of F is

A. 160 N

B. 240 N

C. 320 N

D. 400 N

Answer: b

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18. At t=0, the shape of a travelling pulse is given by

$$y(x, 0) = \frac{4 \times 10^{-3}}{8 - (x)^{-2}}$$

where x and y are in metres. The wave function for the travelling pulse if the velocity of propagation is $5m/s$ in the x direction is given by

A. $y(x, t) = \frac{4 \times 10^{-3}}{8 - (x^2 - 5t)}$

B. `y(x,t)=(4xx10^(-3))/(8-(x-5t)^(2))

C. $y(x, t) = \frac{4 \times 10^{-3}}{8 - (x + 5t)^2}$

D. $y(x, t) = \frac{4 \times 10^{-3}}{8 - (x^2 + 5t)}$

Answer: b

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19. The amplitude of a wave represented by displacement equation $y = \frac{1}{\sqrt{a}}\sin\omega t \pm \frac{1}{\sqrt{b}}\cos\omega t$ will be

A. $\frac{a+b}{ab}$

B. $\frac{\sqrt{a}+\sqrt{b}}{ab}$

C. $\frac{\sqrt{a}\pm\sqrt{b}}{ab}$

D. $\sqrt{\frac{a+b}{ab}}$

Answer: d

Watch Video Solution

20. two particle of medium disturbed by the wave propagation are at $x_1 = 0$ and $x_2 = 1cm$. The respective displacement (in cm) of the particles can be given by the equation:

$y_1 = 2\sin 3\pi t, y_2 \sin(3\pi t - \pi/8)$ the wave velocity is

A. $16cm/s$

B. $24cm/s$

C. $12cm/s$

D. $8cm/s$

Answer: b

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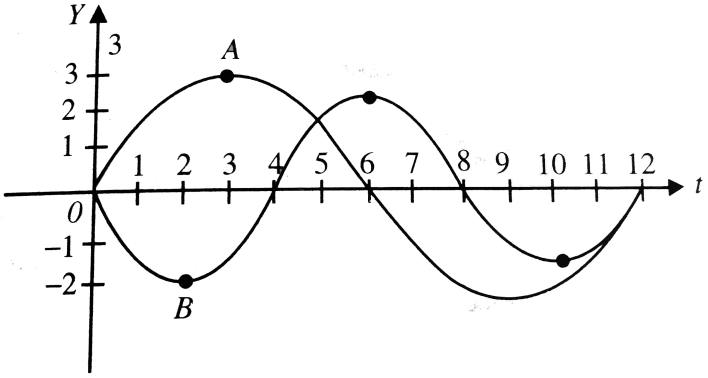
21. The displacement vs time graph for two waves A and B which travel along the same string arre shown in the figure. Their intensity ratio $I_A \mid I_B$ is



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

B. 1

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

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

Answer: b

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22. At t=0,a transverse wave pulse travelling in the positive x direction with a speed of $2m/s$ in a wire is described by the function $y = 6/x^2$ given that $x \neq 0$. Transverse velocity of a particle at x=2 m and t= 2 s is

A. $3m/s$

B. $-3m/s$

C. $8m/s$

D. $-8m/s$

Answer: b

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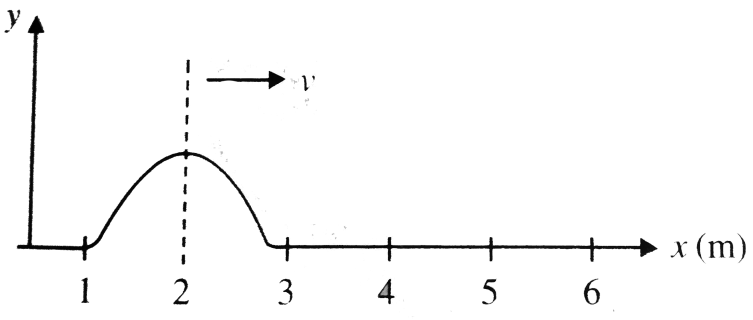
23. Wave pulse on a string shown in figure is moving to the right without changing shape. Cosider two particle at positions $x_1 = 1.5m$ and $x_2 = 2.5m$. Their transverse velocities at the moment shown in figure are along direction



A. positive y-axis and positive y-axis, respectively

B. negative y-axis and positive y-axis, respectively

C. positive y-axis and negative y-axis, resppectively

D. negative y-axis and negative y-axis, respectively

Answer: b

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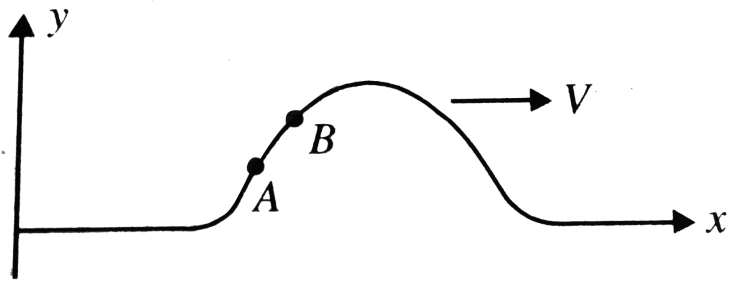
24. A wave pulse is generated in a string that lies along $x -$ axis. At the points A and B, as shown in figure, if R_A and R_B are ratio of magnitudes of wave speed to the particle speed, then



A. $R_A > R_B$

B. $R_B > R_A$

C. $R_B = R_A$

D. information is not sufficient

Answer: a

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25. Sinusoidal waves $5.00cm$ in amplitude are to be transmitted along a string having a linear mass density equal to $4.00 \times 10^{-2} kg/m$. If the source can deliver a maximum power of $90W$ and the string is under a tension of $100N$, then the highest frequency at which the source can operate is (take $\pi^2 = 10$)

A. 45.3 Hz

B. 50 Hz

C. 30 Hz

D. 62.3 Hz

Answer: c

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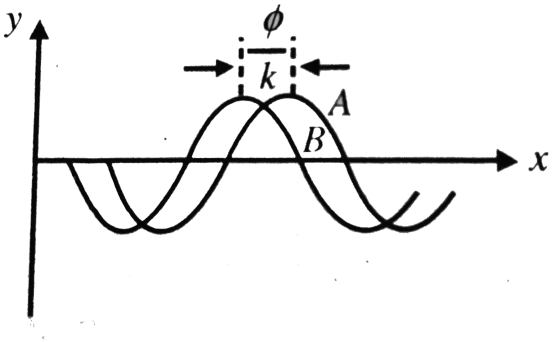
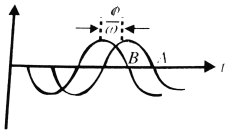
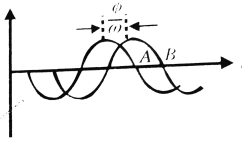
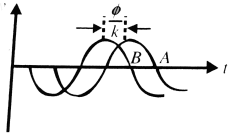
26. Adjoining figure shows the snapshot of two waves A and B at any time t. the equation for A is $y = A\sin(kx - \omega t - \phi)$, and for B it is $y = A\sin(kx - \omega t)$. It is clearly shown in the figure that

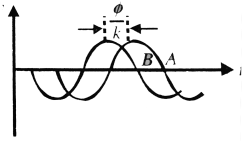
wave A is ahead of B by a distance ϕ / k.



A. 

B. 

C. 

D. 

Answer: b

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27. A transverse sinusoidal wave is generated at one end of a long horizontal string by a bar that moves the end up and down through a distance by $2.0cm$. the motion of bar is continuous and is repeated regularly 125 times per second. If klthe distance between adjacent wave crests is observed to be $15.6cm$ and the wave is moving along positive $x-$ direction, and at $t=0$ the element of the string at $x=0$ is at mean position $y=0$ and is moving downward, the equation of the wave is best described by

A. $y=(1cm)\sin[(40.3rad/m)x-(786rad/s)t]$

B. $y = (2cm)\sin[(40.3rad/m)x - (786rad/s)t]$

C. $y = (1cm)\cos[(40.3rad/m)x - (786rad/s)t]$

D. $y = (2cm)\cos[(40.3rad/m)x - (786rad/s)t]$

Answer: a

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28. If the maximum speed of a particle on a travelling wave is v_0, then find the speed of a particle when the displacement is half of the maximum value.

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

B. $\frac{\sqrt{3v_0}}{4}$

C. $\frac{\sqrt{3v_0}}{2}$

D. v_0

Answer: c

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29. A sinusoidal wave is genrated by moving the end of a string up and down, periodically. The genrated must apply the energy has .....x and least power when the end of the string attached to genrated to genrated has .....Y. the most suitable option which correctly fills blanks X and Y, is

A. maximum displacement, least acceleration

B. maximum displacement, maximum acceleration

C. least displacement, maximum acceleration

D. least displacement, least acceleration

Answer: c

Watch Video Solution

30. A point source of sound is placed in a non-absorbing medium two points A and B are at the distance of 1 m and 2 m, respectively, from the source. The ratio of amplitudes of waves at A to B is

A. $1:1$

B. $1:4$

C. $1:2$

D. $2:1$

Answer: d

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31. Two canoes are $10m$ apart on a lake . Each bobs up and down with a period of $4.0s$. When one canoe is at its highest point , the other canoe is at its lowest point . Both canoes are always within a single cycle of the waves . The canoes are always within a single cycle of the waves . The speed of wave is .

A. $2.5m / s$

B. $5m / s$

C. $40m / s$

D. $4m / s$

Answer: b

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32. The mathmaticaly form of three travelling waves are given by

$Y_1 = (2cm)\sin(3x - 6t)$

$Y_2 = (3cm)\sin(4x - 12t)$

And $Y_3 = 94cm)\sin(5x - 11t)$

of these waves,

A. Wave 1 has greatest wave speed and greatest maximum transverse string speed

B. wave 2 has greatest wave speed and wave 1 has greatest maximum transverse string speed

C. wave 3 has greatest wave speed and wave 1 has greatest maximum transverse string speed

D. wave 2 has greatest wave speed and wave 3 has greatest maximum transverse string speed

Answer: d

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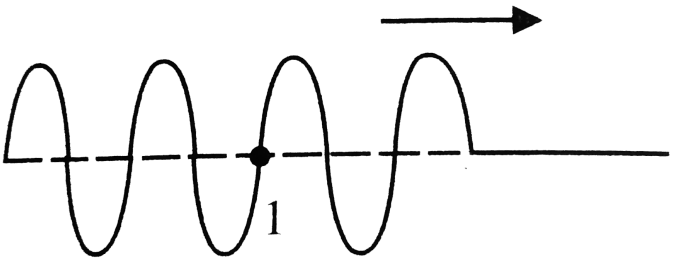
33. A transverse wave on a string travelling along + ve x-axis has been shown in the figure below:

The mathmetical form of the shown wave is

$$y = (3.0cm)\sin\left[2\pi \times 0.1t - \frac{2\pi}{100}x\right]$$

where t is in seconds and x is in centimetres. Find the total distance travelled by the particle at (1) in 10 min 15 s.

measured from the instant shown in the figure and direction of its motion at the end of this time.



A. 6 cm, in upward direction

B. 6 cm, in downward directiion

C. 738 cm, in upward direction

D. 732 cm, in upward direction

Answer: c

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34. A water surface is moving at a speed of $15m/s$. When he is surfing in the direction of wave, he swing upwards every 0.8 s because of wave crests. While surfing in opposite direction to that of wave motion, he swings upwards every 0.6 s. determine the wavelength of transverse component of the water wave.

A. 15 m

B. 10.3 m

C. 21.6 m

D. information insufficient

Answer: b

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35. A transverse wave on a string has an amplitude of 0.2 m and a frequency of 175 Hz. Consider a particle of the string at x=0. it begins with a displacement y=0, at t=0, according to equation $y = 0.2\sin(kx \pm \omega t)$. How much time passed between the first two instant when this particle has a displacement of y=0.1 m?

A. 1.9 ms

B. 3.9 ms

C. 2.4 ms

D. 0.5 ms

Answer: a

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36. If a wave is going from one medium to another, then

A. its frequency change

B. its wavelength does not change

C. its speed does not change

D. its amplitude may change

Answer: D

Watch Video Solution

37. At t=0,a transverse wave pulse travelling in the positive x direction with a speed of $2m/s$ in a wire is described by the function $y = 6/x^2$ given that $x \neq 0$. Transverse velocity of a particle at x=2 m and t= 2 s is

A. $3m/s$

B. $-3m/s$

C. $8m/s$

D. $-8m/s$

Answer: b

Watch Video Solution

38. A harmonic wave has been set up on a very long string which travels along the length of string. The wave has frequency of 50 Hz. Amplitude 1 cm and wavelength 0.5 m. for the above described wave.

Statement (i): time taken by a point on the string to travel a distance of 8 m along the length of string is 0.32 s.

Statement (ii): time taken by a point in the string to travel a distance of 8m, once the wave has reached at that point and sets it into motion is 0.32 s.

A. Both the statement are correct

B. statement I is correct but statement II is incorect

C. statement I is incorrect but statement II is correct

D. both the statement are incorrect

Answer: b

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39. A point source of sound is placed in a non-absorbing medium two points A and B are at the distance of 1 m and 2

m, respectively, from the source. The ratio of amplitudes of waves at A to B is

A. $1:1$

B. $1:4$

C. $1:2$

D. $2:1$

Answer: d

Watch Video Solution

40. 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.

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

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

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

a wave travelling in the positive x-direction with a wavelength 0.2 m

A. in the positive direction with a velocity $1.5m/s$ and wavelength 0.2 m

B. un the negative direction with a velocity $1.5m/s$ and wavelength 0.2 m

C. in the positive direction with a velocity $2m/s$ and wavelength 0.2 mk

D. in the negative direction with a velocity $2m/s$ and wavelength 1.5 m

Answer: a

Watch Video Solution

41. A progressive wave is given by

$y = 3\sin 2\pi[(t/0.04) - (x/0.01)]$

where x, y are in cm and t in s. the frequency of wave and maximum accelration will be:

A. $100Hz, 4.7 \times 10^3 m/s^2$

B. $50Hz, 7.5 \times 10^3 m/s^2$

C. $25Hz, 4.7 \times 10^4 m/s^2$

D. $25Hz, 7.5 \times 10^4 m/s^2$

Answer: d

Watch Video Solution

42. 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. (i) and (ii)

B. (ii) and (iii)

C. (i) and (iii)

D. (ii) and (iv)

Answer: a

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43. The equuation of a wave is given by

$y = 0.5 \sin(100t + 25x)$

The ratio of maximum particle velolcity to wave velocity is:

A. 12.5

B. 25

C. 4

D. $1/8$

Answer: a

Watch Video Solution

44. The phase difference between two waves.

$$y_1 = 10^{-6}\sin\left\{100t + \left(\frac{x}{50}\right) + 0.5\right\}m$$

$$y_2 = 10^{-6}\sin\left\{100t + \left(\frac{x}{50}\right)\right\}m$$

where, x is expressed in metre and t is expressed in second ,

is approximately

A. 1.07 rad

B. 2.07 rad

C. 0.5 rad

D. 1.5 rad

Answer: a

Watch Video Solution

45. Which of the following is not true for the progressive wave

$$y = 4\sin 2\pi\left(\frac{t}{0.02} - \frac{x}{100}\right)$$

where x and y are in cm and t in seconds.

A. The amplitude is 4 cm

B. The wavelength is 100 cm

C. The frequency is 50 Hz

D. The velocity of propagation is $2cm/s$

Answer: d

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46. The amplitude of a wave disturbance propagating along positive X-axis is given by $= \frac{1}{1+x^2}$ at t=0 and $y = \frac{1}{1+(x-2)^2}$ at t=4 s where x and y are in metre. The shape of wave diturbance does not change with time. The velocity of the wave is

A. $0.5m/s$

B. $1m/s$

C. $2c\frac{m}{s}$

D. $4m/s$

Answer: a

Watch Video Solution

47. Consider a wave rpresented by $y = a\cos^2(\omega t - kx)$ where symbols have their usual meanings. This wave has

A. an amplitude a, frequency ω, and wavelength λ.

B. an amplitude a, frequency 2ω, and wabvelength 2λ.

C. an amplitude $a/2$ frequency 2ω and wavelength $\lambda/2$.

D. am amplitude $a/2$ frequency 2ω, and wavelength λ.

Answer: c

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48. At t=0, a transverse wave pulse in a wire is described by the function $y = 6/\left(x^2 - 3\right)$ where x and y are in metres. The function y(x,t) that describes this wave equation if it is travelling in the positive x direction with a speed of $4.5m/s$ is

A. $y = \dfrac{6}{(x + 4.5t)^2 - 3}$

B. $y = \dfrac{6}{(x - 4.5t)^2 + 3}$

C. $y = \dfrac{6}{(x + 4.5t)^2 + 3}$

D. $y = \dfrac{6}{(x - 4.5t)^2 - 3}$

Answer: d

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49. A stretched rope having linear mass density $5 \times 10^{-2} kg/m$ is under a tension of $80N$. the power that has to be supoplied to the rope to generate harmonic waves at a frequency of $60Hz$ and an amplitude of $\frac{2\sqrt{2}}{15\pi} m$ is

A. 215 W

B. 251 w

C. 512 w

D. 521 w

Answer: c

Watch Video Solution

50. A string of length 2L, obeying hooke's law, is stretched so that its extension is L. the speed of the transverse wave travelling on the string is v. If the string is further stretched so that the extension in the string becomes 4L. The speed of transverse wave travelling on the string will be

A. $\frac{1}{\sqrt{2}}V$

B. $\sqrt{2}v$

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

D. $2\sqrt{2}v$

Answer: d

Watch Video Solution

51. 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 $y(x, t)$.

A. $Y(x, t) = (0.02m)\sin\left[\left(2\pi m^{-1}\right)x + \left(10\pi s^{-1}\right)t\right]m$

B. $y(x, t) = (0.02m)\cos\left(10\pi s^{-1}\right)t + \left(2\pi m^{-1}\right)xm$

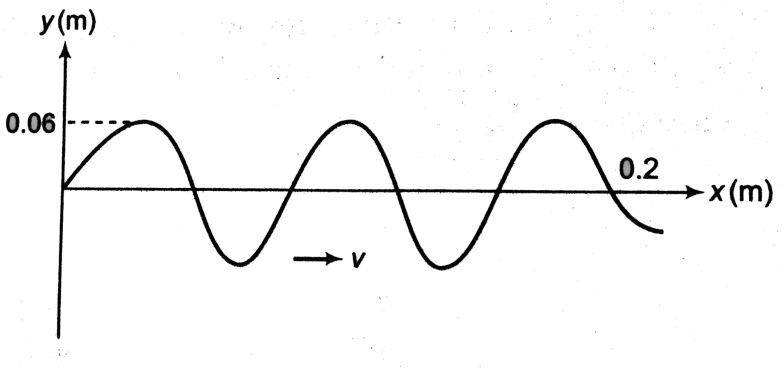
C. $y\left(x, t0 = (0.02m)\sin\left[\left(2\pi m^{-1}\right)x - \left(10\pi s^{-1}\right)t\right]m\right.$

D. $y(x, t) = (0.02m)\sin\left[\left(\pi m^{-1}\right)x + \left(\pi s^{-1}\right)t\right]m$

Answer: c

Watch Video Solution

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



A. $y = (0.06m)\cos\left[\left(78.5m^{-1}\right)x + \left(23562s^{-1}\right)t\right]m$

B. $y = (0.06m)\sin\left[\left(78.5m^{-1}\right)x - \left(23562s^{-1}\right)t\right]m$

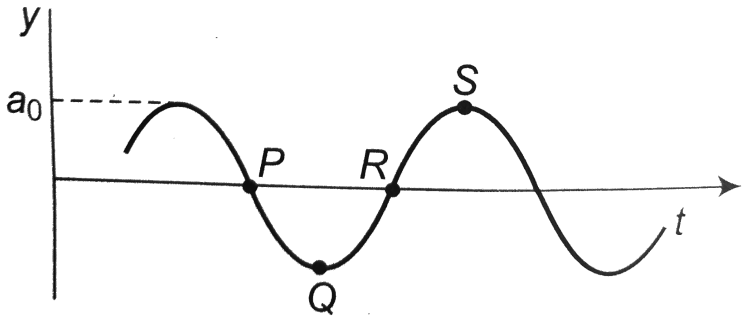
C. $y = (0.06m)\sin\left[\left(78.5m^{-1}\right)x + \left(23562s^{-1}\right)t\right]m$

D. $y = (0.06m)\cos\left[\left(78.5m^{-1}\right)x - \left(23562s^{-1}\right)t\right]m$

Answer: b

Watch Video Solution

53.



A wave motion has the function $y = a_0 \sin(\omega t - kx)$. The graph in figure shows how the displacement y at a fixed point varies with time t. Which one of the labelled points Shows a displacement equal to that at the position $x = \frac{\pi}{2k}$ at time $t = 0$?

A. P

B. Q

C. R

D. S

Answer: b

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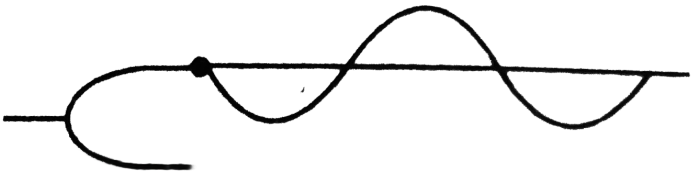
54. The prong of an electrically operated tuning fork is connected to a long string of $\mu = 1kg/m$ and tension 25 N, the maximum velocity of the prong is $1cm/s$, then the average power needed to drive the prong is



A. $5 \times 10^{-4} W$

B. $2.5 \times 10^{-4} W$

C. $1 \times 10^{-4} W$

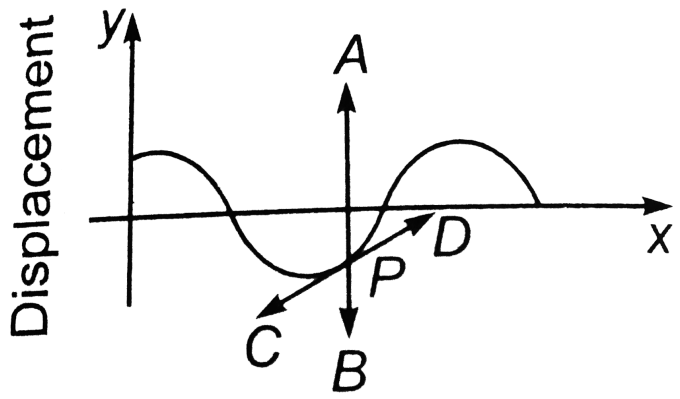
D. $10^{-3} W$

Answer: b

Watch Video Solution

55. The figure below is a representation of a simple harmonic progressive in the negative X-axis, at a given instant. The direction of the velocity of the particle at stage

P in the figure is best represent by the arrow.



A. $\vec{P}\,A$

B. $\vec{P}\,B$

C. $\vec{P}\,C$

D. $\vec{P}\,D$

Answer: a

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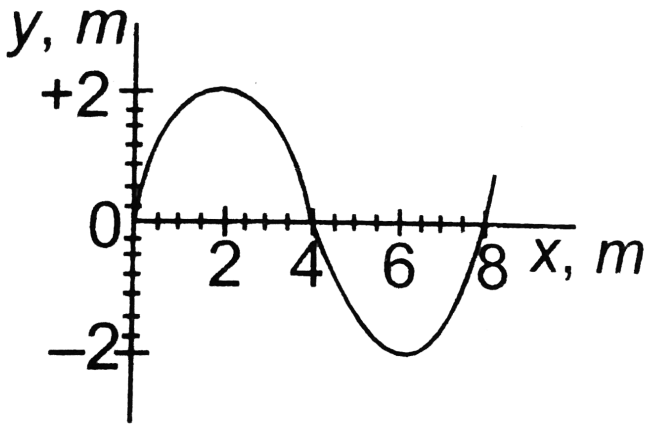
56. The graph shows a wave at t=0 travelling to the right with a velocity of $4m/s$. The equation that best represents the wave is



A. $y(x,t) = 2\sin(\pi x/4 - \pi t) metres$

B. $y(x,t) = 2\sin(16\pi x - 8\pi t) metres$

C. $y(x,t) = 2\sin(\pi x/4 + \pi t) metres$

D. 4 sin(pix//4-pit) metres`

Answer: a

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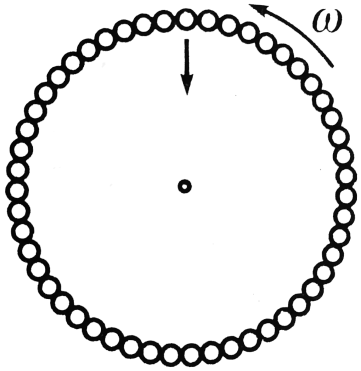
57. A circular loop of rope of length L rotates with uniform angular velocity ω about an axis through its centre on a horizontal smooth platform. Velocity of pulse (with resppect to rope) produce due to slight radiul displacement is given by



A. ωL

B. $\frac{\omega L}{\pi}$

C. $\frac{\omega L}{\pi}$

D. $\frac{\omega L}{4\pi^2}$

Answer: b

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58. In the above question, if equal forces are applied on two springs, then

A. ωL

B. $\frac{\omega L}{2}(\pi)$

C. $\frac{\omega L}{\pi}$

D. $\frac{\omega L}{4\pi^2}$

Answer: c

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59. In the above question,if both are in opposite direction. Then the velocity of the pulse w.r.t. to groun will be:

A. ωL

B. $\frac{\omega L}{2}(\pi)$

C. $\frac{\omega L}{\pi}$

D. 0

Answer: d

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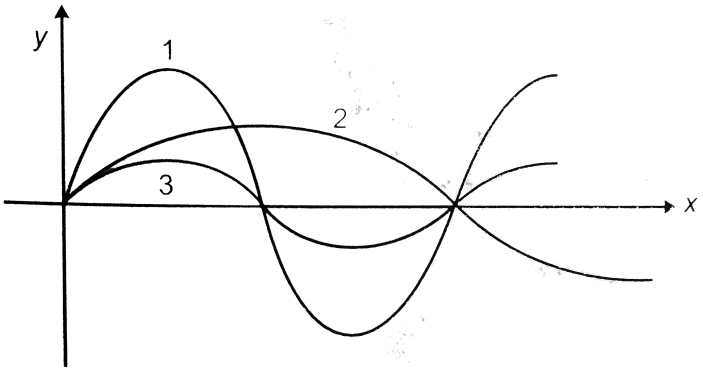
60. Graph shows three waves that are separately sent along a string that is stretched under a certain tension along x-axis. If ω_1, ω_2 and ω_3 are their angular frequencies, respectively, then:



A. $\omega_1 = \omega_3 > \omega_2$

B. $\omega_1 > \omega_2 > \omega_3$

C. $\omega_2 > \omega_1 = \omega_3$

D. $\omega_1 = \omega_2 = \omega_3$

Answer: a

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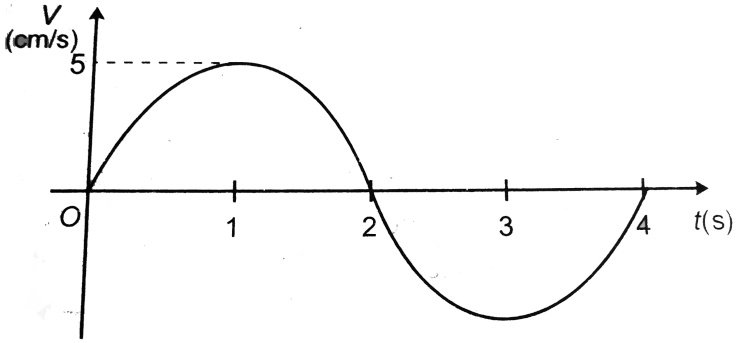
61. A certain transverse sinusoidal wave of wavelength 20 cm is moving in the positive x direction. The transverse velocity of the particle at x=0 as a function of time is shown. The amplitude of the motion is:



A. $\frac{5}{\pi}cm$

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

C. $\frac{10}{\pi}cm$

D. $2\pi cm$

Answer: c

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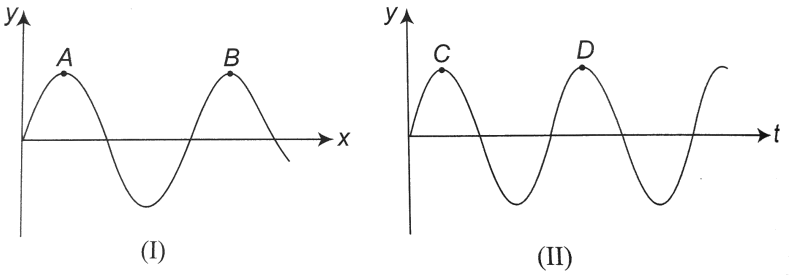

62.

The same progressive wave is represented by two graphs I and II. Graph I shows how the displacement y varies with

the distance x along the wave at a given time. Graph II shows how y varies with time t at a given point on the wave. The ratio of measurements AB to CD, marked on the curves represents:

A. wave number k

B. wave speed V

C. frequency n

D. angular frequency ω

Answer: b

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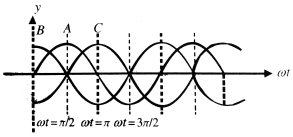
Single Correct Answer

1. The figure shows three progressive waves A, B and c. wahat canbe concluded from the figure that with respect to wave A?



A. The wave C is ahead buy a phase angle of $\pi/2$ and the wave B lags behind by a phase $\pi/2$

B. The wave C is lg behind by a phase angle of $\pi/2$ and the wave B is ahead by a phase angle $\pi/2$

C. The wave C is ahead by a phase angle of pi and the wave B lags behind by a phase angle pi.

D. The wave C lags behind by a phase angle of pi and the wave B is ahead by a phase angle pi.

Answer: b

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Multiple Correct

1. A wave equation which gives the displacement along the y-direction is given by $y = 10^{-4}\sin(60t + 2x)$ where x and y are in meters 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 metres

C. of frequency $30/\pi$ Hertz

D. of amlitude $10^{-4}m$ travelling along the negative x-direction

Answer: a., b., c.,d.

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2. Consider a wave represented by $y = \cos(500t - 70x)$ where y is in millimetres, x in metres and t in second. Which of following are true?

A. The wave is a standing wave

B. the speed of the wave is $50/7m/s$

C. The frequency of oscillation is $500 \times 2\pi$ Hz.

D. Two nearest points in the same phase have separation

$20\pi / 7cm$

Answer: b.,d.

Watch Video Solution

3. A simple harmonic progressive wave in a gas has a particle displacement of y=a at time $t = T/4$ at the orgin of the wave and a particle velocity of y =v at the same instant but at a distance $x = \lambda/4$ from the orgin where T and λ are the periodic time and wavelength of the wave respectively. then for this wave.

A. the amplitude A of the wave is $A = 2a$

B. the amplitude A of the wave is $A = a$

C. the equation of the wave can be represented by

$$y = a\frac{\sin(v)}{a}\left[(t) - \frac{x}{V}\right]$$

D. The equation of the wave can be represented by

$$y = 2a\frac{\cos(v)}{a}\left[t - \frac{x}{V}\right]$$

Answer: b.,c.

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4. The equation to a transverse wave travelling in a rope is given by

$$y = A\frac{\cos(\pi)}{2}[kx - \omega - \alpha]$$

where $A = 0.6m$, $k = 0.005cm^{-1}$, $\omega = 8.0s^{-1}$ and alpha` is a non-vanishing constant. Then for this wave,

A. the wavelength of the wave is $\lambda = 8m$

B. the maximum velocity v_m of a particle of the rope will be, $v_m = 7.53m/s$.

C. the equation of a wave which, when superposed with the given wave can produce standing waves in the rope is $y = A\frac{\cos(\pi)}{2}(kx + \omega - \alpha)$

D. The equation of the wave can be represented by

$y2a\frac{\cos(v)}{a}\left[t + \frac{x}{V}\right]$

Answer: a.,b.,d.

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5. Mark out the correct statement (S) e.r.t. wave speed and particle velocity for a transverse travelling mechanical wave on a string.

A. The wave speed is same for the entire wave, while particle velocity is different for different points at a particular instant.

B. wave speed depends upon property of the medium but not on the wave properties.

C. wave speed depends upon both the properties of the medium and on the properties of waves

D. particle velocity depends upon properties of the wave and not on medium properties.

Answer: a., b., d.

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6. Fore a transverse wave on a string, the string displacement is describrd by

$y(x, t) = f(x - at)$

where f represent a function and a is a negative constant. Then which of the following is//are correct statement(S)?

A. the shape of the string at time $t = 0$ is given by $f(x)$

B. the shape of wave form does not change as it moves along the string

C. waveform moves in +ve x-direction

D. the speed of waveform is a

Answer: a.,b.,d.

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7. If a wave is going from one medium to another, then

A. its frequency change

B. wavelength does not change

C. velocity does not change

D. amplitude may change

Answer: b., c., d.

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8. A wave moves ar a constant speed along a stretched string.Mark the incorrect statement out of the following:

A. particle speed is constant and equal to the wave speed

B. particle speed is independent of amplitude of the periodic mmotion of the source.

C. particle speed is independent of frequency of periodic motion of the source

D. particle speed is dependent on tension and linear mass density the string

Answer: a.,b.,c.,d.

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9. A harmonic wave is travelling along +ve x-axis, on a stretched string. If wavelength of the wave gets doubled, then

A. frequency of wave may change

B. wave speed may change

C. both frequency and speed of wave may change

D. only frequency will change

Answer: a., b., c.,d.

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10. Mark the correct option(s) out of the following:

A. Mechanical waves can be transverse in liquids.

B. in some medium, the speed of a longitudinal mechanical wave is greater than the speed of transverse mechanical wave.

C. transverse waves ate possible in bulk of a liquid.

D. Non-mechanical waves are transverse in nature.

Answer: a., b., d.

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11. Mark out the correct statement(s).

A. A wave can have both transverse and longitudinal components.

B. A wave does not rejult in the bulk flow of the materials of its medium.

C. A wave is a travelling disturbance.

D. A wave can be there even in the absence of an elastic medium.

Answer: a., b., c., d.

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12. Two particles A and B have a phase diference of π when a sine wave passes through the regin

A. A oscillates at half the frequency of B

B. A and B move in opposite direction

C. A and B must be separted by half of the wavelength

D. the displacement of A and B have equal magnitudes

Answer: b., c., d.

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13. As a wave propagates

A. the wave intensity remains constant for a plane wave

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

C. the wave intensity decrese as the inverse of the distance frome a line source

D. total power of the spherical wave over the spherical surface centred at the source remains constant at all the times

Answer: a., b., c., d.

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14. Let a disturbance y be propagated as a plane wave along the x-axis. The wave profile at the instants $t = t_1$ and $t = t_2$ are represent respectively as: $y_1 = f(x_1 - vt_1)$ and y_(2)=f(x_(2)-vt_(2)). The wave is propagating withoute change of shape.

A. the velocity of the wave is v

B. the velocity of the wave is $v = (x_2 + x_1 / (t_2 + t_1)$

C. the particle verlocity is $v_p = -vf(x - vt)$

D. the phase velocity of the wave is v

Answer: a., c., d.

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15. 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 $v = 10m/s$, then λ and f are given by.

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

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

C. $f10^3 / (2\pi) Hz$

D. $f = 10^4 Hz$

Answer: a., c., d.

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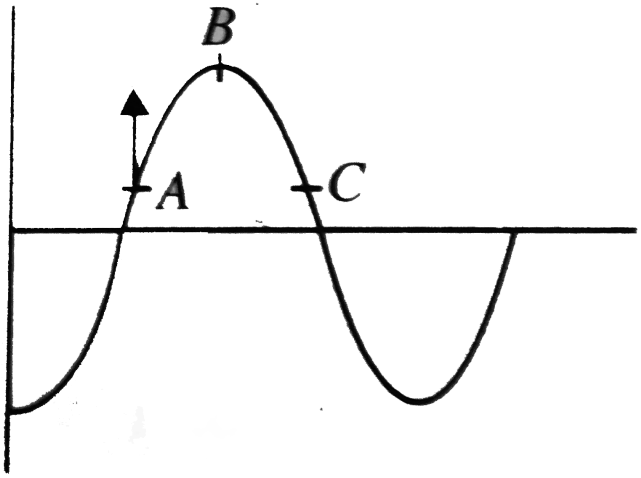
16. A wave is travelling along a string. At an instant shape of the string is as shown in the enclosed figure. At this instant, point A is moving upwards. Which of the following

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 $\pi/2$

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17. Which of the following function represent a travelling wave? Here a,b and c are constant.

A. $y = a\cos(bx)\sin(ct)$

B. $y = a\sin(bx + ct)$

C. $y = a\sin(bx + ct) + a\sin(bx - ct)$

D. $y = a\sin(bx - ct)$

Answer: b., d.

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18. A wave is represented by the equation

$$y = A \sin 314 \left[\frac{t}{0.5s} - \frac{x}{100m} \right]$$

The frequency is n and the wavelength is λ.Then:

A. $n = 2Hz$

B. $n = 100Hz$

C. $\lambda = 2m$

D. $\lambda = 100m$

Answer: b., c.

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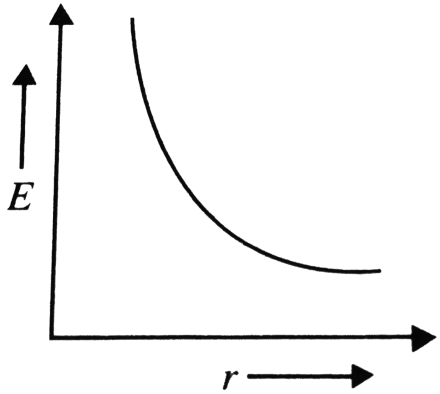
19. Energy density E (energy per unit volume) of the medium ar a distance r from a sound source varies acording

to the curve shown in figure. Which of the following are possible?



A. The source may be a point isotropic source

B. if the source is a plane source then the medium particle have damped oscillations

C. if the source is a plane source then power of the sourcee is decresing with time

D. density of the medium decrease with distance r from the source

Answer: a., b., d.

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20. Equation of a wave travelling in a medium is: $y = a\sin(bt - cx)$. Which of the following are correct?

A. Ratio of the displacement amplitude, eith which the particles of the medium oscillate, to the wavelength is equal to $ac/2\pi$

B. Ratio of the velocity oscillation amplitude of medium particles to the wave propagation velocity is equal to

ac

C. oscillation amplitude of relative deformation of the medium is directly proportional to velocity oscillation amplitude of medium particles

D. non of the above

Answer: a., b., c.

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21. 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 $4cm$, $16cm$, $32cm/s$ and 1 Hz, respectively, with wave propagating along-x direction

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

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

D. two positions occupied by the particle at seperation of $12cms$ have a phase difference of 135°

Answer: b., c., d.

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22. 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. $m = 20kg$

B. $M = 5kg$

C. $\frac{m}{M} = \frac{1}{2}$

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

Answer: a., d.

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23. $y(x,t) = 0.8/\left[(4x+5t)^2+5\right]$ represents a moving pulse, where x and y are in meter and t in second. Then

A. pulse is moving in +x direction

B. in 2 s 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.

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24. A transverse wave travelling on a taut string is represented by:

$Y = 0.01 \sin 2\pi(10t - x)$

Y and x are in meters and t in seconds. Then,

A. The speed of the wave is $10m / s$.

B. closet points on the string which differ in phase by 60° are $(1/6)m$ apart

C. maximum particle velocity is $\pi / 4m / s$

D. the phase of a certain point on the string changes by 120° in $(1/20)$ seconds.

Answer: a., b.

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25. Fore a transverse wave on a string, the string displacement is describrd by

$y(x, t) = f(x - at)$

where f represent a function and a is a negative constant. Then which of the following is//are correct statement(S)?

A. Shape of the string at time $t = 0$ is given by $f(x)$.

B. The shape of waveform does not change as it moves along the string.

C. waveform moves in $+ve$ x-direction.

D. The speed of wveform is a.

Answer: a., b., d.

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Assertion-Reasoning

1. Staement I: pressure and density change do not occure in a transverse stationary wave.

Statement II: the average distance between any two particles of the wave remains the same.

A. Statement I is true, statement II is true and statement II is the correct explaination for statement I.

B. Statement I is true, statement II is true and statement II is NOT the correct explaination for statement I.

C. Statement I is true, statement II is false.

D. Statement I is false, statement II is true.

Answer: b

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2. Statement I:In a progressive logitudinal wave, the amplitude of the wave will not be the same at all points of the medium along the direction of motion of the wave.

Statement II: there is a continuous change of the phase angle of the wave as it progressive in the direction of motion.

A. Statement I is true, statement II is true and statement II is the correct explaination for statement I.

B. Statement I is true, statement II is true and statement II is NOT the correct explaination for statement I.

C. Statement I is true, statement II is false.

D. Statement I is false, statement II is true.

Answer: d

3. Assertion: In a small segment of string carrying sinusoidal wave, total energy is conserved.

Reason: Every small part moves in SHM and total energy of SHM is conserved.

A. Statement I is true, statement II is true and statement II is the correct explaination for statement I.

B. Statement I is true, statement II is true and statement II is NOT the correct explaination for statement I.

C. Statement I is true, statement II is false.

D. Statement I is false, statement II is true.

Answer: d

4. Statement I: two waves moving in a uniform string having uniform tension cannot have different velocities.

Elastic and inertial properties of string are same for all waves in same string. Moreover speed of wave in a string depends on its elastic and inertial properties only.

A. Statement I is true, statement II is true and statement II is the correct explaination for statement I.

B. Statement I is true, statement II is true and statement II is NOT the correct explaination for statement I.

C. Statement I is true, statement II is false.

D. Statement I is false, statement II is true.

Answer: a

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5. Statement I: waves genrated in a metal piece can be transverse or longitudinal.

statement II: waves generated depend upon the method of creating waves in the metal.

A. Statement I is true, statement II is true and statement II is the correct explaination for statement I.

B. Statement I is true, statement II is true and statement II is NOT the correct explaination for statement I.

C. Statement I is true, statement II is false.

D. Statement I is false, statement II is true.

Answer: a

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6. statement I: The intensity of a plane progressive wave does not change with change in distance from the source.

Statement II: The wavefronts associated with a plane progressive wave are planar.

A. Statement I is true, statement II is true and statement II is the correct explaination for statement I.

B. Statement I is true, statement II is true and statement II is NOT the correct explaination for statement I.

C. Statement I is true, statement II is false.

D. Statement I is false, statement II is true.

Answer: a

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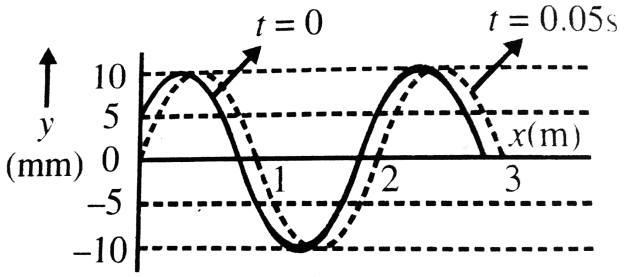
Comprehension

1. The figure represents two snaps of a travelling wave on a string of mass per unit length $\mu = 0.25kg/m$. The first snap is taken at t=0 and the second is taken at $t = 0.05s$.



Determine the speed of the wave.

A. $20/3m/s$

B. $10/3m/s$

C. $20m/s$

D. $10m/s$

Answer: b

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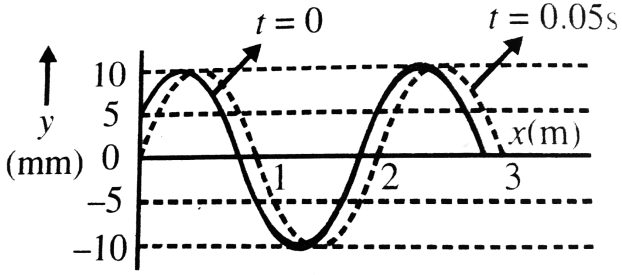
2. The figure represents two snaps of a travelling wave on a string of mass per unit length $\mu = 0.25kg/m$. The first snap is taken at t=0 and the second is taken at $t = 0.05s$.



Determine the frequency of the wave.

A. $5/3Hz$

B. $10/3m/s$

C. $5Hz$

D. $10Hz$

Answer: a

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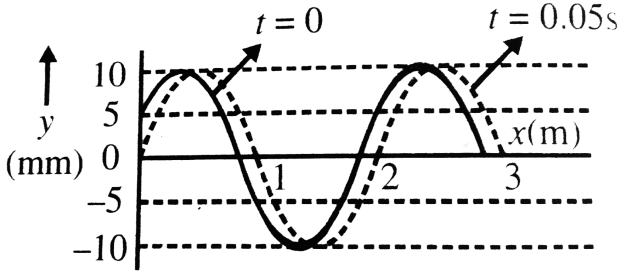
3. The figure represents two snaps of a travelling wave on a string of mass per unit length $\mu = 0.25kg/m$. The first snap is taken at t=0 and the second is taken at $t = 0.05s$.



Determine the maximum speed of the particle.

A. $\frac{7}{20}\pi m/s$

B. $\frac{5}{13}\pi m/s$

C. $\frac{\pi}{30}m/s$

D. (7pi)/(20)m//s`

Answer: c

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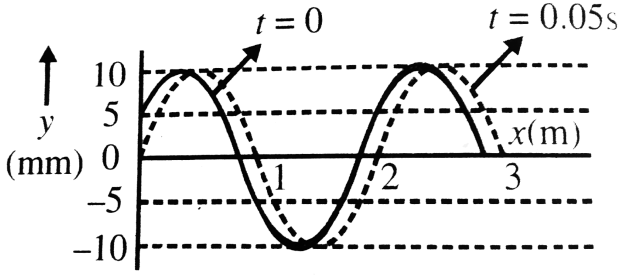
4. The figure represents two snaps of a travelling wave on a string of mass per unit length $\mu = 0.25kg/m$. The first snap is taken at t=0 and the second is taken at $t = 0.05s$.



Determine the tension in the string.

A. $25/3N$

B. $25/7N$

C. $5N$

D. $25/9N$

Answer: d

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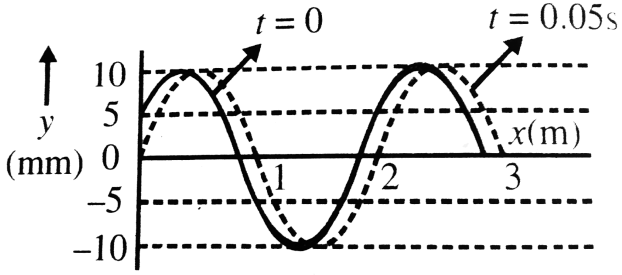
5. The figure represents two snaps of a travelling wave on a string of mass per unit length $\mu = 0.25kg/m$. The first snap is taken at t=0 and the second is taken at $t = 0.05s$.



Determine the equation of the wave.

A. $y10\sin 2\pi x - 10/3\pi t\pi/6$

B. $y\pi 10\sin\pi\pi x - \pi 10/3\pi\pi t\pi\pi\pi/3\pi\pi$

C. $y\pi 10\sin\pi\pi x - \pi 10/3\pi\pi t\pi\pi\pi/6\pi\pi$

D. $y\pi 10\sin\pi\pi x - \pi 5/3\pi\pi t\pi\pi\pi/3\pi\pi$

Answer: c

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

time t = 0.05 s ? (c) What is the velocity of this particle at this instant ?

A. $20m/s$

B. $10m/s$

C. $80m/s$

D. $40m/s$

Answer: c

Watch Video Solution

7. A long string having a cross- sectional area $0.80mm^2$ and density $12.5gcm^{-3}$ is subjected to a tension of 64 N along the X-axis. One end of this string is attached to a vibrator

moving in transverse direction at a frequency fo 20Hz. At t = 0. the source is at a maximujm displacement y= 1.0 cm. (a) Write the equation for the wave. (b) What is the displacement of the particle of the string at x = 50 cm at time t = 0.05 s ? (c) What is the velocity of this particle at this instant ?

A. $y = (1.0cm)\cos\left[\left(40\pi s^{-1}\right)t - \left\{\left(\pi/2m^{-1}x\right\}\right]\right.$

B. $y = (1.0cm)\cos\left[\left(40\pi s^{-1}\right)t + \left\{\left(\pi/2m^{-1}x\right\}\right]\right.$

C. $y = (1.0cm)\cos\left[\left(40\pi s^{-1}\right)t - \left\{\left(\pi/4m^{-1}x\right\}\right]\right.$

D. $y = (1.0cm)\cos\left[\left(40\pi s^{-1}\right)t + \left\{\left(\pi/4m^{-1}x\right\}\right]\right.$

Answer: a

Watch Video Solution

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

A. $\frac{1}{\sqrt{2}}cm$

B. $\sqrt{2}cm$

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

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

Answer: a

Watch Video Solution

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

A. $10\sqrt{2}\pi cm/s$

B. $40\sqrt{2}\pi cm/s$

C. $30\sqrt{2}\pi cm/s$

D. $20\sqrt{2}\pi cm / s$

Watch Video Solution

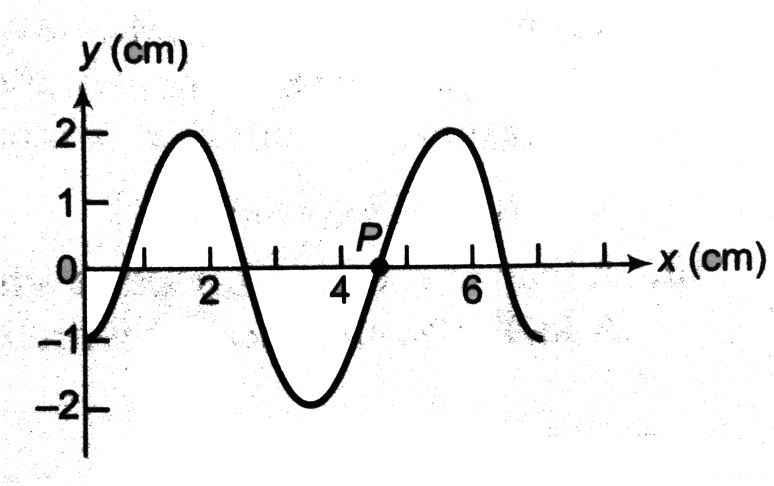
10. Consider a sinusoidal travelling wave shown in figure. The wave velocity is $+40cm / s$.

Find

(a) the frequency

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

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



A. $20Hz$

B. $30Hz$

C. $25Hz$

D. $10Hz$

Watch Video Solution

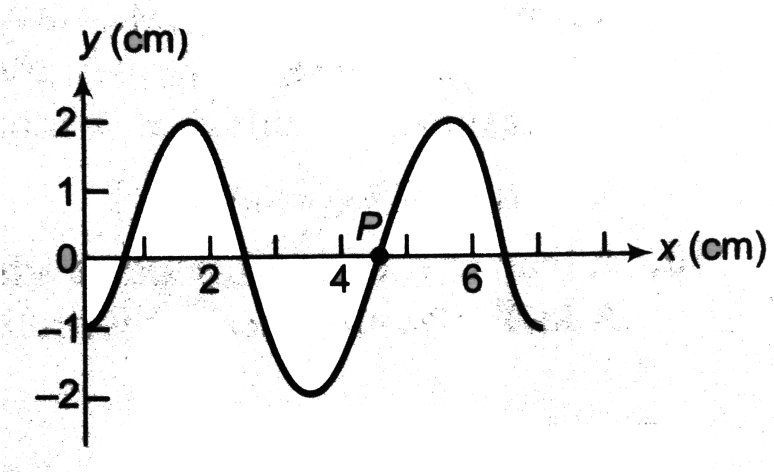
11. Consider a sinusoidal travelling wave shown in figure. The wave velocity is $+40cm/s$.

Find

(a) the frequency

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

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



A. $3\pi/4rad$

B. $5\pi/4rad$

C. $7\pi/4rad$

D. $9\pi / 4rad$

Answer: b

Watch Video Solution

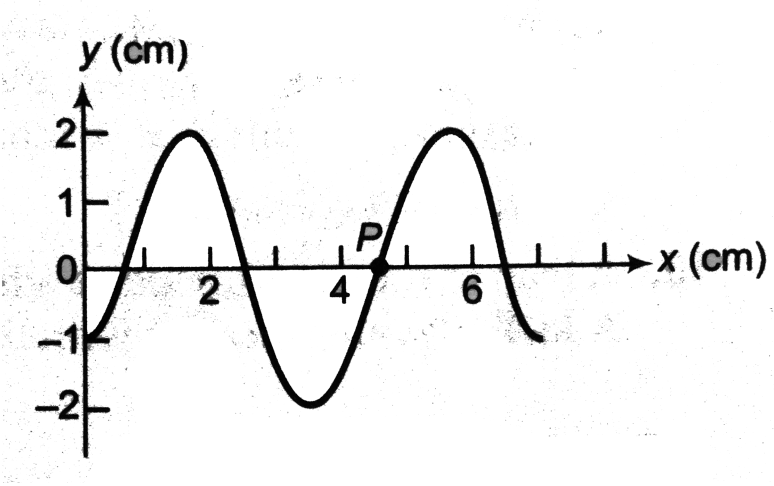
12. Consider a sinusoidal travelling wave shown in figure. The wave velocity is $+40cm / s$.

Find

(a) the frequency

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

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



A. $1/30s$

B. $1/60s$

C. $1/20s$

D. $1/40s$

Answer: b

Watch Video Solution

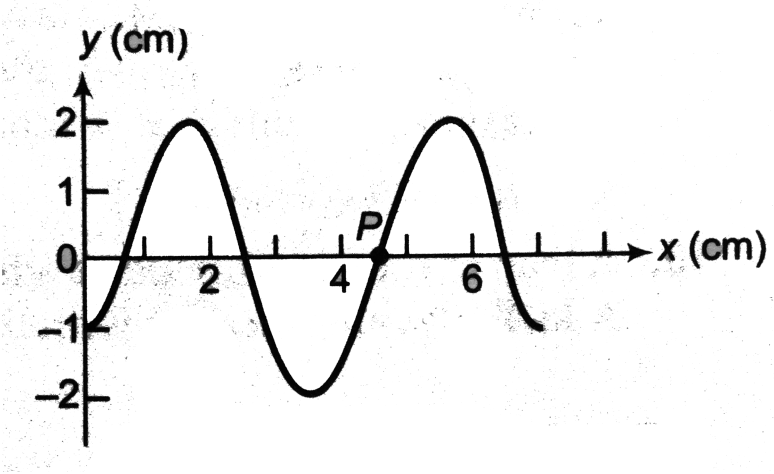
13. Consider a sinusoidal travelling wave shown in figure. The wave velocity is $+40cm/s$.

Find

(a) the frequency

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

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



A. $1.26m/supward$

B. $1.26m/4$ downward

C. $3.52m/s$ upward

D. none of these

Answer: b

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14. A plane wave propagates along positive x-direction in a homogeneous medium of density $p = 200kg/m^3$. Due to propagation of the wave medium particle oscillate. Space density of their oscillation energy is $E = 0.16\pi^2 J/m^3$ and maximum shear strain produced in the mendium is $\phi_0 = 8\pi \times 10^{-5}$. if at an instant, phase difference between two particles located at points $(1m, 1m, 1m)$ and $(2m, 2m, 2m,)$ is $\Delta\theta = 144^\circ$, assuming at $t = 0$ phase of particle at $x = 0$ to be zero,

Wave velocity is

A. $300m/s$

B. $400m/s$

C. $500m/s$

D. $100\frac{m}{s}$

Answer: c

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15. A plane wave propagates along positive x-direction in a homogeneous medium of density $p = 200kg/m^3$. Due to propagation of the wave medium particle oscillate. Space density of their oscillation energy is $E = 0.16\pi^2 J/m^3$ and maximum shear strain produced in the mendium is $\phi_0 = 8\pi \times 10^{-5}$. if at an instant, phase difference between

two particles located at points $(1m, 1m, 1m)$ and $(2m, 2m, 2m,)$ is $\Delta\theta = 144^\circ$, assuming at $t = 0$ phase of particle at $x = 0$ to be zero,

wave length is

A. $2.5m$

B. $5m$

C. $10m$

D. $6m$

Answer: a

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16. A plane wave propagates along positive x-direction in a homogeneous medium of density $p = 200kg/m^3$. Due to propagation of the wave medium particle oscillate. Space density of their oscillation energy is $E = 0.16\pi^2 J/m^3$ and maximum shear strain produced in the mendium is $\phi_0 = 8\pi \times 10^{-5}$. if at an instant, phase difference between two particles located at points $(1m, 1m, 1m)$ and $(2m, 2m, 2m,)$ is $\Delta\theta = 144^\circ$, assuming at $t = 0$ phase of particle at $x = 0$ to be zero,

Equation of wave is

A. $y\pi 10^{-4} \sin \pi\pi 2000t - 0.8x\pi$

B. $y\pi 10^{-4} \sin \pi\pi 400t - 0.8x\pi$

C. $y\pi 10^{-4} \sin \pi\pi 100t - 8x\pi$

D. $y\pi 10^{-4} \sin \pi\pi 100t - 2x\pi$

Answer: b

Watch Video Solution

17. A sinusoidal wave is propagating in negative x-direction in a string stretched along x-axis. A particle of string at $x = 2$ cm is found at its mean position and it is moving in positive y-direction at $t = 1$ s. the amplitude of the wave, the wavelength and the angular frequency of the wave are $0.1m$, $\pi / 4m$ and $4\pi rad / s$, respectively.

The equation of the wave is

A. $y = 0.1 \sin(4\pi(t-1) + 8(x-2))$

B. $y = 0.1 \sin((t-1) - (x-2))$

C. $y = 0.1 \sin(4\pi(t-1) - 8(x-2))$

D. none of these

Answer: a

Watch Video Solution

18. A sinusoidal wave is propagating in negative x-direction in a string stretched along x-axis. A particle of string at $x = 2$ cm is found at its mean position and it is moving in positive y-direction at $t = 1$ s. the amplitude of the wave, the wavelength and the angular frequency of the wave are $0.1m$, $\pi / 4m$ and $4\pi rad / s$, respectively.

The speed of particle at $x = 2m$ and $t = 1s$ is

A. $0.2\pi m / s$

B. $0.6\pi m / s$

C. $0.4\pi m / s$

D. 0

Answer: c

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19. A sinusoidal wave is propagating in negative x-direction in a string stretched along x-axis. A particle of string at $x = 2$ cm is found at its mean position and it is moving in positive y-direction at $t = 1$ s. the amplitude of the wave, the wavelength and the angular frequency of the wave are $0.1m$, $\pi / 4m$ and $4\pi rad / s$, respectively.

The equation of the wave is

The speed of particle at $x = 2m$ and $t = 1s$ is

The instantaneous power transfer through $x = 2m$ and $t = 1.125s$ is

A. $10J/s$

B. $4\pi/3J/s$

C. $2\pi/3J/s$

D. 0

Answer: d

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20. Four pieces of string of length L are joined end to end to make a long string of length 4L. The linear mass density of the strings are $\mu, 4\mu, 9\mu$ and 16μ, respectively. One end of

the combined string is tied to a fixed support and a transverse wave has been generated at the other end having frequency f (ignore any reflection and absorption). string has been stretched under a tension F. Find the time taken by wave to reach from source end to fixed end.

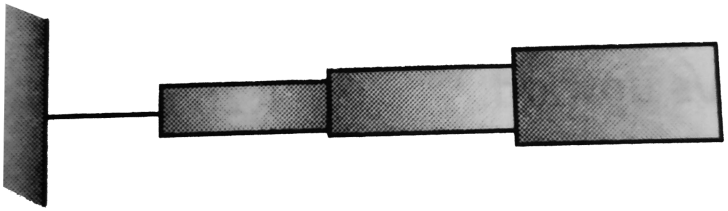

Fig. 5.63

A. $\frac{25}{12} \times \frac{L}{\sqrt{F/\mu}}$

B. $\frac{10L}{\sqrt{F/\mu}}$

C. $\frac{4L}{\sqrt{F/\mu}}$

D. $\frac{L}{\sqrt{F/\mu}}$

Answer: b

Watch Video Solution

21. Four pieces of string of length L are joined end to end to make a long string of length 4L. The linear mass density of the strings are $\mu, 4\mu, 9\mu \text{ and } 16\mu$, respectively. One end of the combined string is tied to a fixed support and a transverse wave has been generated at the other end having frequency f (ignore any reflection and absorption). string has been stretched under a tension F.

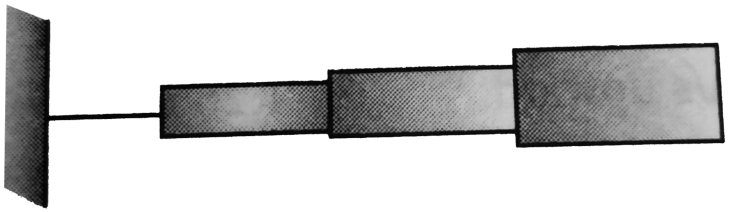

Fig. 5.63

Find the ratio of wavelength of the wave on four string, starting from right hand side.

A. $12:6:4:3$

B. $4:3:2:1$

C. $3:4:6:12$

D. $1:2:3:4$

Answer: c

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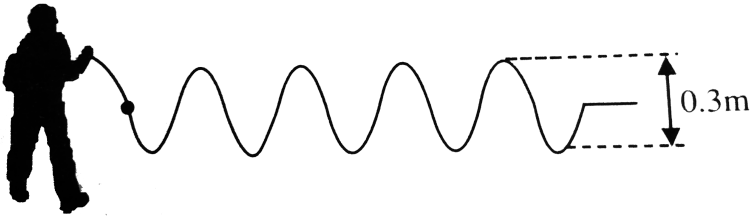
22. figure. Shows a student setting up wave wave on a long stretched string. The student's hand makes one complete up and down movement in $0.4s$ and in each up and down movement the hand moves by a height of $0.3m$. The wavelength of the waves on the string is $0.8m$.



The frequency of the wave is

A. $2.5Hz$

B. $5Hz$

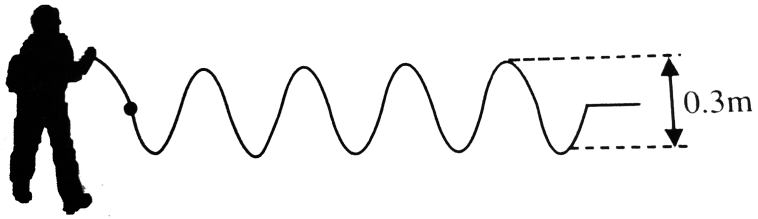
C. $1.25Hz$

D. Cannot be predicated

Answer: a

Watch Video Solution

23. figure. Shows a student setting up wave wave on a long stretched string. The student's hand makes one complete up and down movement in $0.4s$ and in each up and down movement the hand moves by a height of $0.3m$. The wavelength of the waves on the string is $0.8m$.



The amplitude of the wave is

A. $0.15m$

B. $0.3m$

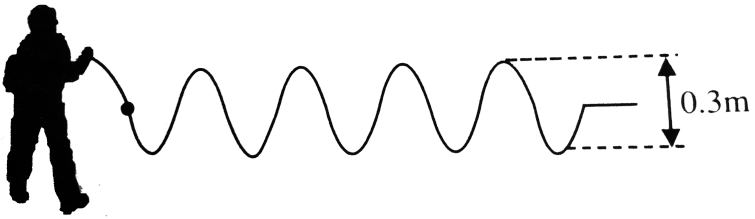
C. $0.075m$

D. Cannot be predicated

Answer: a

Watch Video Solution

24. figure. Shows a student setting up wave wave on a long stretched string. The student's hand makes one complete up and down movement in $0.4s$ and in each up and down movement the hand moves by a height of $0.3m$. The wavelength of the waves on the string is $0.8m$.



The wave speed is

A. $2m / s$

B. $0.3m$

C. $0.075m$

D. Cannot be predicated

Answer: a

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25. 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. $y = (0.1m)\cos[(2rad/s)x - (12.5rad/s)t]$

B. $y = (0.1m)\cos[(1.26rad/s)x - (18.8rad/s)t]$

C. $y = (0.1m)\cos[(1.5rad/s)x - (10rad/s)t]$

D. $y = (0.1m)\cos[(1.5rad/s)x - (4rad/s)t]$

Answer: b

Watch Video Solution

26. 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=-(0.1 m) cos(12.5 rad//s)t

B. $y = 0.1m\cos(12.5rad/s)t$

C. $y = (0.1m)\sin(4rad/s)t$

D. $y = -(0.1m)\sin(10rad/s)t$

Answer: a

Watch Video Solution

27. 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. $\pi/2$

B. $3\pi/2$

C. $\pi / 4$

D. π

Answer: d

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28. One end of a long rope is tied to a fixed vertical pole. The rope is stretched horizontally with a tension $8N$. Let us cinsider the length of the rope to be along x-axis. A simple harmonic oscillator at $x = 0$ generates a transverse wave of frequency $100Hz$ and amplitude $2cm$ along the rope. Mass of a unit length of the rope is $20g / m$. ignoring the effect of gravity, answer the following quetions.

Tension in the given rope remaining the same, if a simple

harmonic oscillator of frequency $200Hz$ is used instead of the earlier oscillator of frequency $100Hz$

A. $50cm$

B. $20cm$

C. $8cm$

D. $32cm$

Answer: b

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29. One end of a long rope is tied to a fixed vertical pole. The rope is stretched horizontally with a tension $8N$. Let us cinsider the length of the rope to be along x-axis. A simple

harmonic oscillator at $x = 0$ generates a transverse wave of frequency $100Hz$ and amplitude $2cm$ along the rope. Mass of a unit length of the rope is $20g/m$. ignoring the effect of gravity, answer the following quetions.

Tension in the given rope remaining the same, if a simple harmonic oscillator of frequency $200Hz$ is used instead of the earlier oscillator of frequency $100Hz$

A. $-(0.02m)\cos[8\pi(rad/m)x - 100\pi(rad/s)t]$

B. $(0.02m)\cos[10\pi(rad/m)x - 200\pi(rad/s)t]$

C. $-(0.02m)\cos[10\pi(rad/m)x - 200\pi(rad/s)t]$

D. $(0.02m)\cos[8\pi(rad/m)x - 100\pi(rad/s)t]$

Answer: c

Watch Video Solution

30. One end of a long rope is tied to a fixed vertical pole. The rope is stretched horizontally with a tension $8N$. Let us cinsider the length of the rope to be along x-axis. A simple harmonic oscillator at $x = 0$ generates a transverse wave of frequency $100Hz$ and amplitude $2cm$ along the rope. Mass of a unit length of the rope is $20g/m$. ignoring the effect of gravity, answer the following quetions.

Tension in the given rope remaining the same, if a simple harmonic oscillator of frequency $200Hz$ is used instead of the earlier oscillator of frequency $100Hz$

A. The wave propagates with a fixed speed 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 varible speed.

C. The wave propagates with a varible speed but any particle of the medium vibrates with some fixed speed.

D. The wave propagates with a varible speed and any particle of the medium also vibrates with a varible speed.

Answer: b

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31. One end of a long rope is tied to a fixed vertical pole. The rope is stretched horizontally with a tension $8N$. Let us

cinsider the length of the rope to be along x-axis. A simple harmonic oscillator at $x = 0$ generates a transverse wave of frequency $100Hz$ and amplitude $2cm$ along the rope. Mass of a unit length of the rope is $20g/m$. ignoring the effect of gravity, answer the following quetions.

maximum magnitude of transverse acceleration of any point on the rope will be nearly

A. $7888m/s^2$

B. $8244m/s^2$

C. $9277m/s^2$

D. $3333m/s^2$

Answer: a

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32. One end of a long rope is tied to a fixed vertical pole. The rope is stretched horizontally with a tension $8N$. Let us cinsider the length of the rope to be along x-axis. A simple harmonic oscillator at $x = 0$ generates a transverse wave of frequency $100Hz$ and amplitude $2cm$ along the rope. Mass of a unit length of the rope is $20g/m$. ignoring the effect of gravity, answer the following quetions.

Tension in the given rope remaining the same, if a simple harmonic oscillator of frequency $200Hz$ is used instead of the earlier oscillator of frequency $100Hz$

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

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33. A rope is attached at one end to a fixed vertical pole . It is stretched horizontal with a fixed value of tension T . Suppose at $t = 0$, a pulse is generated by moving the free end of the rope up and down once with your hand. The pulse arrives at the pole at instant t.

Ignoring the effect of gravity, answer the following

quetions.

A.. If you move your hand up and down once but to a greater distance and in the same amount of time.

A. Time taken for the pulse to reach the pole will increase and it will be doubled

B. Time taken for the pulse to reach the pole will deacrease and it will become half

C. Time taken for the pulse to reach the pole will not change

D. Cannot change

Answer: c

Watch Video Solution

34. A rope is attached at one end to a fixed vertical pole . It is stretched horizontal with a fixed value of tension T . Suppose at $t = 0$, a pulse is generated by moving the free end of the rope up and down once with your hand. The pulse arrives at the pole at instant t.

Ignoring the effect of gravity, answer the following quetions.

If you move your hand up and down once by the same amount but do it more rapidly, say, twice as fast as in the earlier case.

A. Time taken for the pulse to reach the pole will increase

B. Time taken for the pulse to reach the pole will not change

C. Time taken for the pulse to reach the pole will deacrease

D. Time taken for the pulse to reach the pole may increase or decrease

Answer: b

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35. A rope is attached at one end to a fixed vertical pole . It is stretched horizontal with a fixed value of tension T . Suppose at $t = 0$, a pulse is generated by moving the free end of the rope up and down once with your hand. The pulse arrives at the pole at instant t.

Ignoring the effect of gravity, answer the following

quetions.

If you use a string of same length but of greater mass

A. Time taken for the pulse to reach the pole will not change

B. Time taken for the pulse to reach the pole will increase

C. Time taken for the pulse to reach the pole will deacrease

D. Time taken for the pulse to reach the pole may increase or decrease

Answer: b

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36. A rope is attached at one end to a fixed vertical pole . It is stretched horizontal with a fixed value of tension T . Suppose at $t = 0$, a pulse is generated by moving the free end of the rope up and down once with your hand. The pulse arrives at the pole at instant t.

Ignoring the effect of gravity, answer the following quetions.

In all the above, quetions we have considered a fixed value of tension. however, if tension in a given rope is increased and a pulse is genrated as described,

A. Time taken for the pulse to reach the pole may increase to decrease

B. Time taken for the pulse to reach the pole will not change

C. Time taken for the pulse to reach the pole will increase

D. Time taken for the pulse to reach the pole will deacrease

Answer: d

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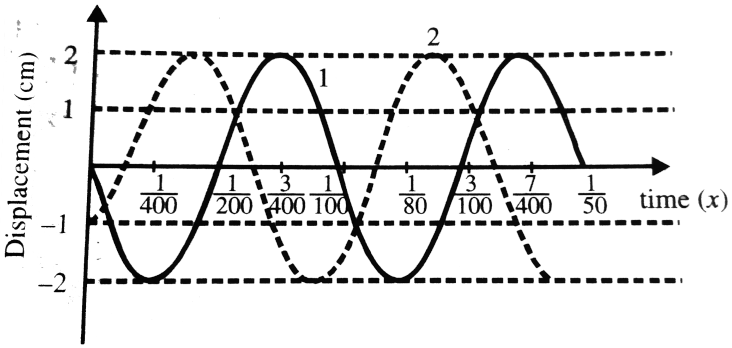
37. A simple harmonic plane wave propagatees along x-axis in a medium. The displacement of the particle as a function of time is shown in figure, for $x = 0$(curve 1) and $x = 7$ (curve 2)

The two particle are with a span of onewavelength.



The wavelength of the wave is

A. $6cm$

B. $24cm$

C. $12cm$

D. $16cm$

Answer: c

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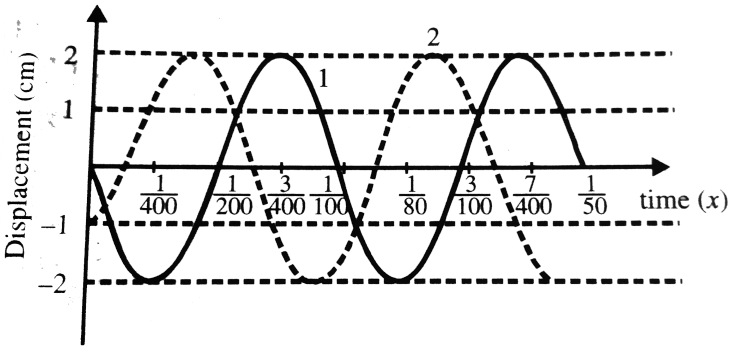
38. A simple harmonic plane wave propagatees along x-axis in a medium. The displacement of the particle as a function of time is shown in figure, for $x = 0$(curve 1) and $x = 7$ (curve 2)

The two particle are with a span of onewavelength.



The speed of the wave is

A. $12m/s$

B. $24m/s$

C. $8m/s$

D. $16m/s$

Answer: a

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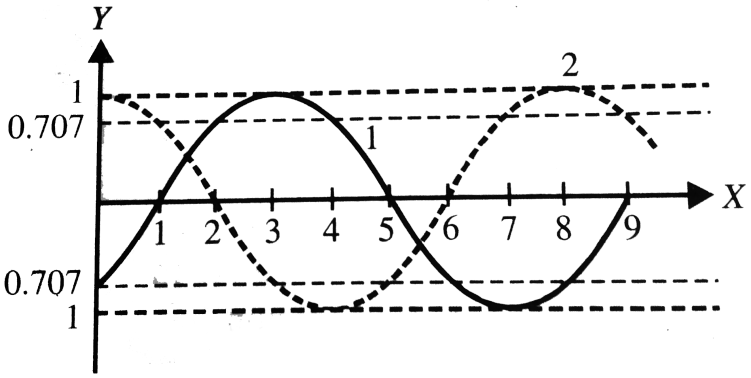
39. Figure. shows two snapshots of medium particle supporting a plane progressive wave travelling along positive $x-$ axos, corresponding to instants $t=0.002s$ and $t=0.008s$, respectively shown by curves numbered 1 and 2.

Assume that the interval between the two snapshots is less

than the time period. Velocity of the wave is



A. $\frac{1700}{3} m/s$

B. $\frac{1700}{5} m/s$

C. $\frac{2500}{7} m/s$

D. $\frac{2500}{3} m/s$

Answer: d

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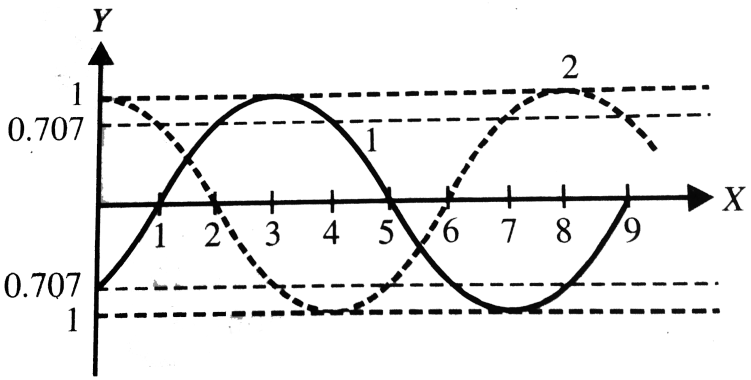
40. Figure .shows two snapshots of medium particle supporting a plane progressive wave travelling along positive x-axos, corresponding to instants $t = 0.002s$ and $t = 0.008s$, respectively shown by curves numbered 1 and 2. Assume that the interval between the two snapshots is less than the time period.The frequency of the wave



A. $52s^{-1}$

B. $205s^{-1}$

C. $104s^{-1}$

D. $54s^{-1}$

Answer: c

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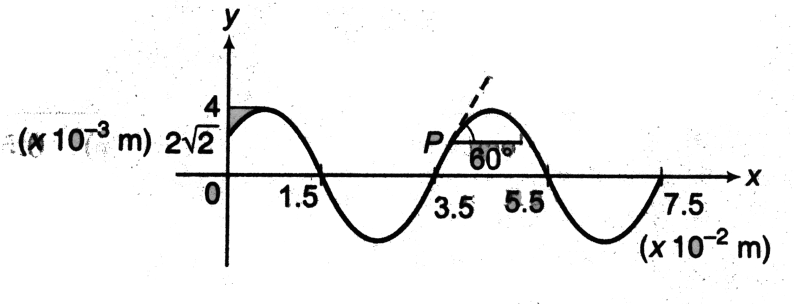
41. The figure shows a snap photograph of a vibrating string at $t = 0$. The particle P is observed moving up with velocity $20\sqrt{3}cm/s$. The tangent at P makes an angle 60° with x-axis.



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

(b) Write the equation of the wave.

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

A. $40cm/s$

B. $60cm/s$

C. $80cm/s$

D. $20cm/s$

Answer: d

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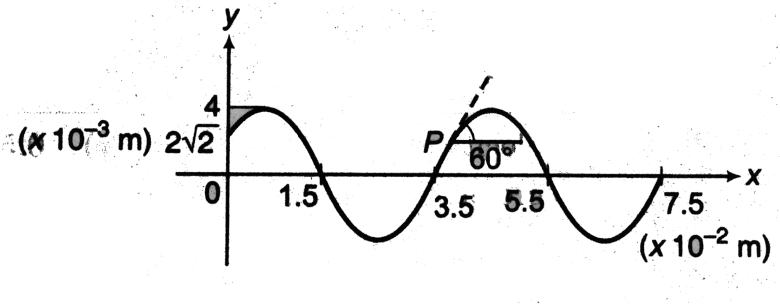
42. The figure shows a snap photograph of a vibrating string at $t = 0$. The particle P is observed moving up with

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 $50g/m$.

A. $y5 \times 10^{-3} \sin\left(10\pi t - 50\pi x - \frac{\pi}{8}\right)$

B. $y4 \times 10^{-3} \sin\left(10\pi t - 50\pi x - \frac{\pi}{8}\right)$

C. $y\left(5 \times 10^{-3}\left(\sin\left(10\pi t\left(50\pi x - \frac{\pi}{8}\right)\right)\right)\right)$

D. $y\left(4 \times 10^{-3}\left(\sin\left(10\pi t\left(50\pi x - \frac{\pi}{8}\right)\right)\right)\right)$

Answer: d

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43. A pulse is started at a time $t = 0$ along the $+x$direction on a long, taut string. The shape of the pulse at $t = 0$ is given by function $f(x)$ with

$$\begin{cases} \frac{x - vt}{4} + 1 & f \text{ or } vt - 4 < x \leq vt \\ -(x - vt) + 1 & f \text{ or } vt < x < vt + 1 \end{cases}$$

0, otherwise

here f and x are in centimeters. The linear mass density of the string is $50g/m$ and it is under a tension of $5N$.

C..The transverse velocity of the particle at $x = 13cm$ and $t = 0.015s$ will be

A. $2cm^2$

B. $2.5cm^2$

C. $4cm^2$

D. $5cm^2$

Answer: b

Watch Video Solution

44. A pulse is started at a time $t = 0$ along the $+x$direction on a long, taut string. The shape of the pulse at $t = 0$ is given by function $f(x)$ with

$$\begin{cases} \frac{x-vt}{4}+1 & f \text{ or } vt-4 < x \leq vt \\ -(x-vt)+1 & f \text{ or } vt < x < vt+1 \end{cases}$$

0, otherwise

here f and x are in centimeters. The linear mass density of the string is $50g/m$ and it is under a tension of $5N$.

C..The transverse velocity of the particle at $x = 13cm$ and $t = 0.015s$ will be

A. $0.75cm$

B. $0.5cm$

C. $0.25cm$

D. `zero

Answer: c

Watch Video Solution

45. A pulse is started at a time $t = 0$ along the $+x$direction on a long, taut string. The shape of the pulse at $t = 0$ is given by function $f(x)$ with

here f and x are in centimeters. The linear mass density of the string is $50g/m$ and it is under a tension of $5N$.

The transverse velocity of the particle at $x = 13cm$ and $t = 0.015s$ will be

A. (a) $-250cm/s$

B. (b) $-500cm/s$

C. (c) $500cm/s$

D. (d) $-1000cm/s$

Answer: a

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Integer

1. The speed of a transverse wave going on a wire having a length 50 cm and maas 5.0 g is $80ms^{-1}$ The area of cross section of the wire is $1.0mm.^{2}$ and its Young modulus is $16 \times 10^{11} Nm^{-2}$. Find the extension of the wire over its natural lenth.

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2. A wave pulse passing on a string with speed of $40cms^{-1}$ in the negative x direction has its maximum at $x = 0$ at $t = 0$. Where will this maximum be located at `t=5s?

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3. A particle on a stretched string supporting a travelling wave, takess $5.0s$ to move from its mean position to the extreme position. The distance between two consecutive particle, which are at their mean position, is $3.0cm$. Find the wave speed ($\in m/s$).

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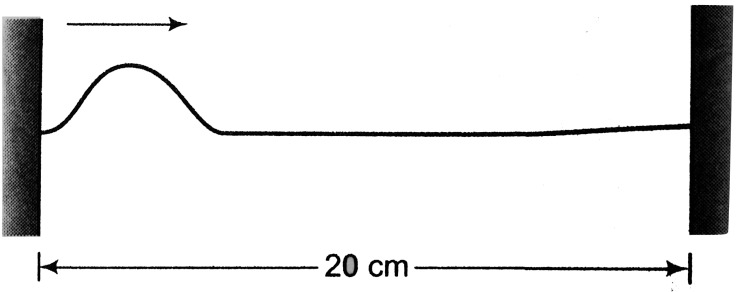
4. A string of length 20 cm and linear mass density $0.4g/cm$ is fixed at both ends and is kept under a tension of 16 N. A wave pulse is produced at t=0 near an end as shown in figure which travels towards the other end. (a) When will the string have the shape shown in the figure again? (b) Sketch the shape of the string at a time half of that found in

part (a).



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5. A string of length 40 cm and weighing 10 g is attached to a spring at one end and to a fixed wall at the other end. The spring has a spring constant of $160 Nm^{-1}$ and is stretched by 1.0 cm. If a wave pulse is produced on the string near the wall, how much time will it take to reach the spring ?

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6. 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 $2.0ms^{-2}. Takeg = 10ms^{-2}$.

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7. A plane progressive wave is given by $x = (40cm)\cos(50\pi t - 0.02\pi y)$ where y is in cm and t in s. The particle velocity at $y = 25m$ in time $t = \frac{1}{200}s$ will be $10\pi\sqrt{n}m/s$. What is the value of n.

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8. A travelling wave pulse is given by

$$y = \frac{0.8}{(3x^2 + 12xt + 12t^2 + 4)}$$

where x and y are in m and t is in seconds. Find the velocity of the wave.

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9. An ant with mass m is standing peacefully on top of a horizontal, stretched rope. The rope has mass per unit length μ and is under tension F. Without warning, a student starts a sinusoidal transverse wave of wavelength λ propagating along the rope. the motion of the rope is in a verticle plane. what minimum wave amplitude (in mm) will make the ant feel weightless momentarily? Assume that m is so small that the presence of the ant has no effect on the

propagation of the wave.

[Given:

$\lambda = 0.5m, \mu = 0.1kg/m, F = 3.125N, takeg = \pi^2]$

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Others

1. which of the following function corrtly represent the traveling wave equation for finite values of x and t ?

A. $y = x^2 - t^2$

B. $y = \cos x^2 \sin t$

C. $y = \log(x^2 - t^2) - \log(x - t)$

D. $y = e^{2x} \sin t$

Answer: c

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2. At t=0, a transverse wave pulse travelling in the + ve x-direction with a speed of $2m/s$ in a wire is described by $y = 6/x^2$, given that $x \neq 0$. Transverse velocity of a particle at x=2 m and t=2 s is

A. 3m/s

B. $-3m/s$

C. 8m/s

D. $-8m/s$

Answer: b

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3. A wave travelling in positive X-direction with A = 0.2 m velocity = 360 m/s and λ = 60 m, then correct expression for the wave is : -

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

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

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

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

Answer: c

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

A. Amplitude $A/2$, frequency 2n and wavelength $\lambda/2$

B. Amplitude $A/2$, frequency 2n and wavelength λ

C. Amplitude A, frequency 2n and wavelength 2λ

D. Amplitude A, frequency n and waves

Answer: a

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5. 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

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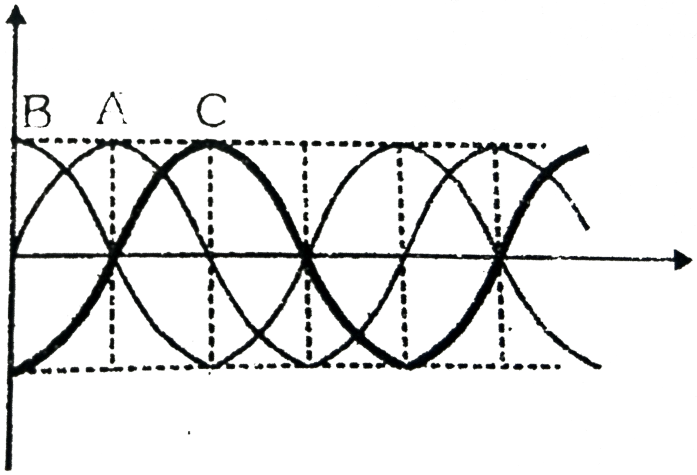
6. Three progressive waves A, B and C are shown in figure.

With respect to wave A



A. The wave C is ahead by a phase angle of $\pi/2$ and the wave B lags behicnd by a phase angle of $\pi/2$

B. The wave C lags behind by a pahse angle of $\pi/2$ and the wave B is ahead by a phase angle of $\pi/2$

C. The wave C is ahead by a phase angle of π and the wave B lags behind by a phase angle of π

D. The wave C lags behind by a phase angle of π and the wave B ahead by a phase angle of π

Answer: b

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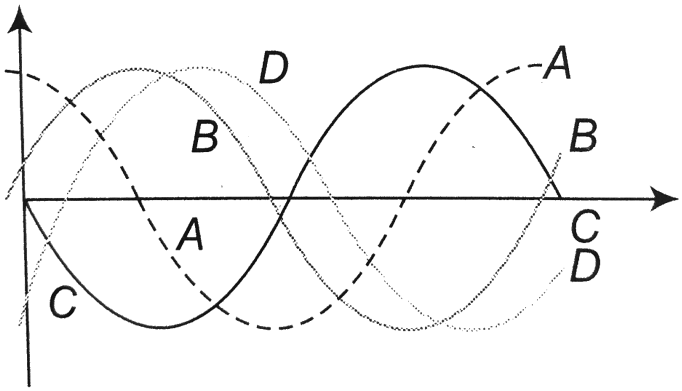
7. Which of the following curves represents correctly the oscillation given by $y = y_0 \sin(\omega t - \phi)$ where $0 < \phi < 90^\circ$?



A. A

B. B

C. C

D. D

Answer: d

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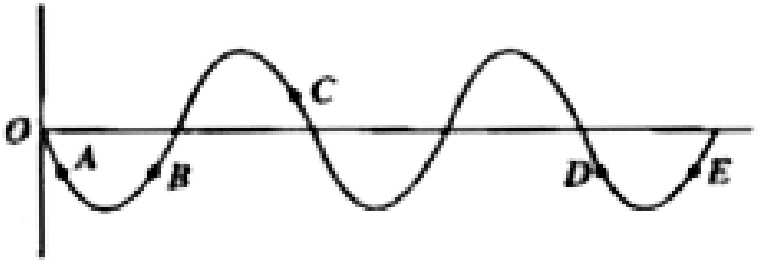
8. The diagram below (Fig. 15.13.1) show the propagation of a wave. Which points are in phase ?



A. F, G

B. C and E

C. B and G

D. B and F

Answer: d

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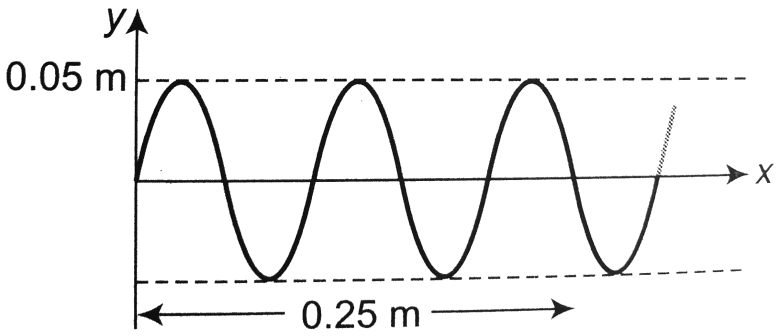

9.

If the speed of the wave shown in the figure is $330m/s$ in the given medium then the equation of the wave propagating in the positive x-direction will be (all quantities are in M.K.S units)

A. $y = 0.05 \sin 2\pi(4000t - 12.5x)$

B. $y = 0.05 \sin 2\pi(4000t - 122.5x)$

C. $y = 0.05 \sin 2\pi(3300t - 10x)$

D. $y = 0.05 \sin 2\pi(3300t - 10t)$

Answer: c

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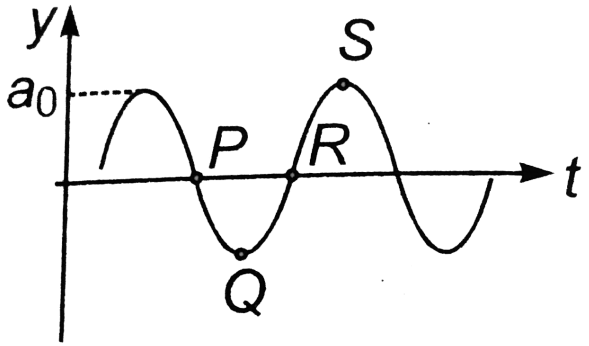
10. The wave motion has the function $y = a_0 \sin(\omega t - kx)$. The graph in the figure shows how the displacement y at a fixed point varies with time t. which one of the labelled points shows a displacement equal to that at the position

$x = \pi / 2k$ at time t=0?`



A. P

B. Q

C. R

D. S

Answer: b

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

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

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

A. Travelling with a velocity of 30m/sec in the negative X direction

B. Of wavelength π metre

C. Of frequency $30/\pi$ Hz

D. Of amplitude 10^4 metre travelling along the negative X direction

Answer: a, b, c, d

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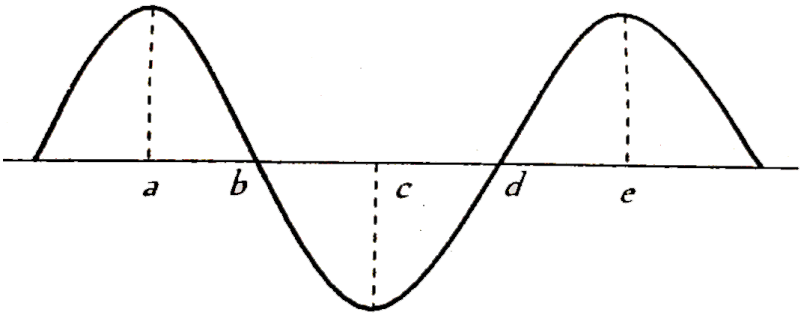
12. The rope shown at an instant is carrying a wave travelling towards right, created by a source vibrating at a frequency n . Consider the following statements



I. The speed of the wave is $4n \times ab$

II. The medium at a will be in the same phase as d after $\frac{4}{3n}s$

III. The phase difference between b and e is $\frac{3\pi}{2}$

Which of these statements are correct

A. The speed of the wave is $4n \times ab$

B. The medium at a will be in the same phase as d after

$$\frac{4}{3n}s$$

C. The phase difference between b and e is $\frac{3\pi}{2}$

D. The speed of the wave is $2n \times ab$

Answer: a, c

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13. $y_t = 2\sin 3\pi t$

$$y_2 = 2\sin\left(3\pi t - \frac{\pi}{8}\right)$$

The wave velocity is , if the path difference is 1cm .

A. $16cm/\sec$

B. $24cm/\sec$

C. $12cm / \sec$

D. $8cm / \sec$

Answer: b

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14. $y_t = 2 \sin 3\pi t$

$y_2 = 2 \sin\left(3\pi t - \frac{\pi}{8}\right)$

The wave velocity is , if the path difference is 1cm .

A. 4cm

B. 2cm

C. 1cm

D. zero

Answer: b

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15. The equation of a wave is $y = 2\sin\pi(0.5x - 200t)$, where x and y are expressed in cm and t in sec. The wave velocity is.....

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16. Equation of a progressive wave is given by

$$y = 0.2\cos\pi\left(0.04t + 0.02x - \frac{\pi}{6}\right)$$

The distance is expressed in cm and time in second. The minimum distance between two particles having the phase difference of $\pi/2$ is.....

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17. At a moment in a progressive wave , the phase of a particle executing S. H. M $\frac{\pi}{3}$. Then the phase of the particle 15 cm ahead and at the time $\frac{T}{2}$ will be , if the wavelength is 60 cm

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18. The equetion of a wave travelling on a string is

$$y = 4\frac{\sin(\pi)}{2}\left(8t - \frac{x}{8}\right)$$

if x and y are in centimetres, then velocity of waves is

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19. A plane wave is represented by

$x = 1.2\sin(314t + 12.56y)$

Where x and y are distances measured along in x and y direction in meters and t is time in seconds. This wave has wavelength

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20. The phase difference between two waves.

$y_1 = 10^{-6}\sin\left\{100t + \left(\frac{x}{50}\right) + 0.5\right\}m$

$y_2 = 10^{-6}\sin\left\{100t + \left(\frac{x}{50}\right)\right\}m$

where, x is expressed in metre and t is expressed in second , is approximately

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21. The equation of a trevelling wave In a uniform string of mass per unit length unit length μ is given as $y = A\sin(\omega - kx)$.Find the total energy transferred through the origin in time interval from t = 0 to $t = \pi/12\omega$. (You can use the formula in instantaneous power if you know)

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22. A transverse wave is propagating along $+x$ direction. At $t = 2$ sec the particle at $x = 4$m is at $y = 2$ mm. With the passage of time its y coordinate increases and reaches to a maximum of 4 mm. The wave equation is (using ω and k with their usual meanings)

A. $y = 4\sin\left(\omega(t+2) + k(x-2) + \frac{\pi}{6}\right)$

B. $y = 4\sin\left(\omega(t+2) + k(x) + \frac{\pi}{6}\right)$

C. $y = 4\sin\left(\omega(t-2) - k(x-4) + \frac{5\pi}{6}\right)$

D. $y = 4\sin\left(\omega(t-2) - k(x-4) + \frac{5\pi}{6}\right)$

Answer: D

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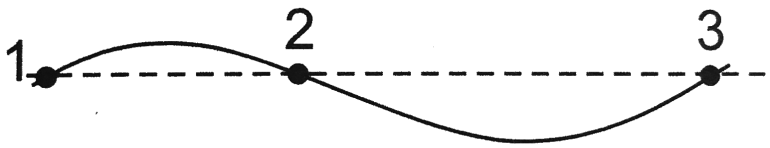

23.

The diagram below shows an instantaneous position of a string as a transverse progressive wave travels along it from left to right Which one of the following correctly shows the

direction of the velocity of the points 1,2 and 3 on the string?

A. $\rightarrow \quad \rightarrow \quad \rightarrow$

B. $\leftarrow \quad \leftarrow \quad \rightarrow$

C. $\downarrow \quad \downarrow \quad \downarrow$

D. $\downarrow \quad \uparrow \quad \downarrow$

Answer: C

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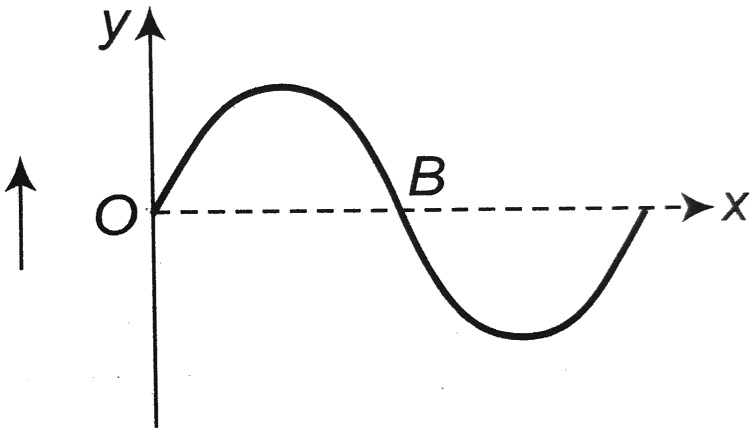

24.

Figure below shows the wave $y = A\sin(\omega t - kx)$ at any instant travelling in the $+ve$ x-direction. What is the slope of the curve at B?

A. ω / A

B. k/A

C. kA

D. ωA

Answer: A

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25. 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. 63 cm/s

B. 75cm/s

C. 100cm/s

D. 121cm/s

Answer: D

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26. A transverse wave is represented by the equation

$$y = y_0 \sin. \frac{2\pi}{\lambda}(vt - x)$$

For what value of λ, the maximum particle velocity equal to two times the wave velocity?

(A) $\lambda = 2\pi y_0$ (B) $\lambda = \frac{\pi y_0}{3}$ (C) $\lambda = \frac{\pi y_0}{2}$ (D) $\lambda = \pi y_0$

A. $\lambda = 2\pi y_0$

B. $\lambda = \pi y_0 3$

C. $\lambda = \pi y_0 2$

D. $\lambda = \pi y_0$

Answer: D

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27. 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

A. ωR

B. $2\omega R$

C. $3\omega R$

D. Zero

Answer: B

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

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

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

A. 32 N

B. 42 N

C. 66 N

D. 80 N

Answer: D

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29. The displacement from the position of equilibrium of a point 4 cm from a source of sinusoidal oscillations is half the amplitude at the moment $t = T/6$ (T is the time perios). Assume that the source was at mean position at $t = 0$. The wavelength of the running wave is :

A. 0.96 m

B. 0.48 m

C. 0.24 m

D. 0.12 m

Answer: B

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30. A wave moving with constant speed on a uniform string passes the point $x = 0$ with amplitude A_0, angular frequency ω_0 and average rate of energy transfer P_0. As the wave travels down the string it gradually loses energy and at the point $x = l$, the average rate of energy transfer becomes $P_0/2$. At the point $x = l$. Angular frequency and amplitude are respectively:

A. $\omega_0 \text{and } \frac{A_0}{\sqrt{2}}$

B. $\frac{\omega_0}{\sqrt{2}} \text{and} A_0$

C. less then ω_0 and A_0

D. $\frac{\omega_0}{\sqrt{2}}$ and $\left(A_0 \frac{0}{\sqrt{2}}\right.$

Answer: A

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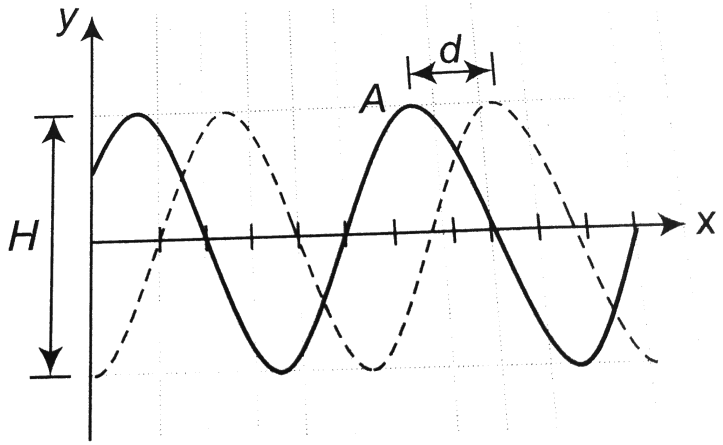

31.

A sinusoidal wave moving along a string is shown twice in the figure. As crest A travels in the positive direction of an x axis by distance $d = 6.0$ cm in $4.0ms$. The tick marks along the axis are separated by $10cm$, height $H = 6.00mm$. The wave equation is

A. $y = (3mm)\sin\left(16x - 2.4 \times 10^2 t\right)$

B. $y = (3mm)\sin\left(16x - 2.4 \times 10^2 t\right)$

C. $y = (3mm)\sin\left(8x + 2.4 \times 10^2 t\right)$

D. $y = (3mm)\sin\left(8x - 2.4 \times 10^2 t\right)$

Answer: A

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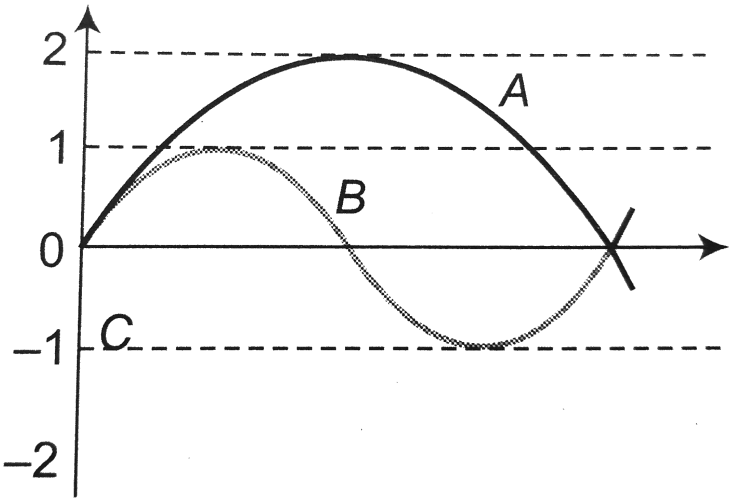

32.

The displacement time graph for two sound waves A and B

are shown in the figure. Then the ratio of their intensities I_A / I_B is equal to

A. $1:2$

B. $1:16$

C. $1:2$

D. $1:1$

Answer: D

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33. As a wave propagates

A. the wave intensity remain constant for a plane wave

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

C. the wave ontensity decrease as the inverse square of the distance from for a spherical wave

D. total intensity of the spherical wave over the spherical surface centered at the source remains constant at all times

Answer: A::C::D

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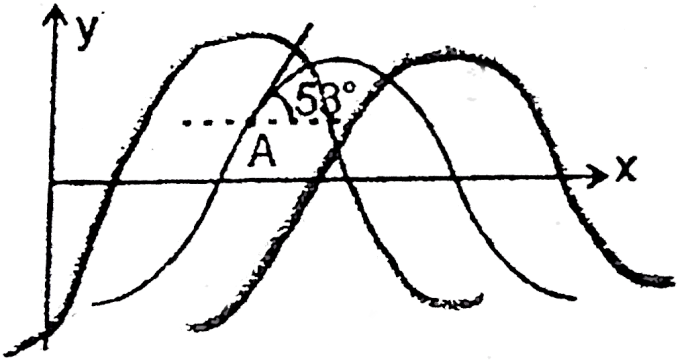
34. $y - x$ curve at an instant for a wave travelling along $x -$ axis on a string is shown. Slope at the point A on the

curve, as shown, is $\tan 53^\circ$.



A. Transerse velocity of the particle at point A is positive if the wave is travelling along positive x axis

B. transverse velocity of the particle a t point A positive if the wave is travelling along negative x axis of the particle at point A

C. Magnitude of transverse velocity of the particle at point A is greater then wave speed

D. Magnitude of transverse velocity on a string of the particle at point A is lesser then wave speed

Answer: B::C

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35. A sinusoidal wave is traveling on a string with speed 40 cm/s. The displacement of the particle of the string at x = 10 cm varies with time according to y = (5.0cm) $\sin\left(1.0 - 4.0s^{-1}\right)t)$ The linear density of the string is 4.0 g/cm

A. the frequency of wave is 0.64 Hz

B. the wavelenght of the wave 63 cm

C. the tension in the string 0.064 N

D. the wave equation is y = (5.0cm) sin

$$\left(0.1x - \left(4.0s^{-1}t\right)\right.$$

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

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