PHYSICS

AIMED AT STUDENTS PREPARING FOR IIT JEE EXAMS

WAVES

Illustration

1. Distinguish between sound waves and radio waves of same frequency, say 15kHz.

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2. An aeroplane flying horizontally makes a sound when its angle of elevation w.r.t a person on ground is θ. But the sound reached the person, when the aeroplane was just over him. Find the mach.no. of the aeroplane. Also find its speed if speed of sound in air is $'v'_s$.

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3. A simple harmonic wave has the equation $y = 3.5\sin(314t - 1.57x)$ where time is measured in second, x in metre and y in c.m. Calculate

(a) Frequency

(b) Wavelength of the wave

Another wave has the equation $y = 0.1\sin(314t - 1.57x + 1.57)$

Calculate the phase difference between this wave and the wave represented by the earlier wave equation.

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4. If a traveling wave is represented by $y = \frac{1}{1 + (2t + 3x)}$ find the direction of wave and velocity.

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

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

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

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6. Given the equation for a wave in a string $y = 0.03\sin(3x - 2t)$ where y and x are in metre and t is in second, answer the following :

1. At $t = 0$, what is the displacement at $x = 0$?

2. At $x = 0.1m$, what is the displacment at $t = 0.2s$?

3. What is the velocity of propagation of the

wave ?

4. What is the equation for the velocity of oscillation of the particles of the string? What is the maximum velocity of oscillation.

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7. A transverse wave described by

$$y = (0.02m)\sin\left[\left(1.0m^{-1}\right)x + \left(30s^{-1}\right)t\right]$$

propagates on a stretched string having a linear mass density of $1.2 \times 10^{-4}kgm^{-1}$. Find the tension in the string.

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8. A wave travelling along the x-axis is described by the equation $v(x, t) = 0.005\cos(\alpha x - \beta t)$. If the wavelength and the time period of the wave are $0.08m$ and $2.0s$, respectively, then α and β in appropriate units are

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9. (a) A string of mass 'm' and length 'L' is suspended from the ceiling and a mass M is hanged from it. Transverse waves are produced at its lowest point (nearM) having wavelength λ, find its wavelength at a distance x from the upper point.

(b) In the previous question, what time a transverse pulse will take to reach from it lowest point to its uppermost point , if the mass M is not hanged from it

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10. 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 $10gm^{-1}$ 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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11. Two wire have cross section diameters d_1 and d_2, length L_1 & L_2 & densities ρ_1 & ρ_2 such that

$d_1 : d_2 : : 1 : 2, L_1 : L_2 : : 2 : 1$ and $\rho_1 : \rho_2 : : 1 : 2$. What weight must be suspended to the $2nd$ wire if the transverse wave produced in it has the same speed as that produced in $1st$ wire, which bears a load of $10 kgwt$.

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12. The elongation in a stretched strings is $\frac{1}{n}$ times its original length. Prove that the ratio of transverse wave velocity and longitudinal wave velocity in the strings is $\frac{1}{\sqrt{n}}$.

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13. The temperature at which the velocity of sound in air becomes double its velocity at $0^\circ C$ is

A. $435^{\circ} C$

B. $694^{\circ} C$

C. $781^{\circ} C$

D. $819^{\circ} C$

Answer: D

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14. Find the speed of sound in a mixture of 1 mole of helium and 2 mole of oxygen at $27^{\circ} C$

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15. What are the factors that are affected for reflected and transmitted waves when a wave is travelled from (a) rarer to denser medium (b) denser to rarer medium ?

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16. The transverse displacement of a string clamped at its both ends is given by

$y(x, t) = 0.06\sin\left(\frac{2\pi}{3}x\right)\cos(l20\pi t)$ where x and y are in m and t in s. The length of the string is 1.5 m and its mass is 3×10^{-2} kg. The tension in the string is

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17. Two travalling wavews of equal amplitudes and equal frequencies move in opposite directions along a string. They interfere to produce a standing wave having the equation $y = A\cos kx \sin \omega t$ in which $A = 1.0mm, k = 1.57cm^{-1}$ and $\omega = 78.5s^{-1}$ (a)

Find the velocity of the component travelling waves. (b) Find the node closet to the origin in the x gt 0. (c) Find the antinode closet to the origin in the region x gt 0 (d) Find the amplitude of the particle at x = 2.33cm.

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18. The equation of a stationary wave is $y = 20\cos 0.5\pi x \sin 100\pi t$. Find the equations of its parent progressive waves.

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19. A one-metre long stretched string having a mass of 40 g is attached to a tuning fork. The fork vibrates at 128 Hz in a direction perpendicular to the string. What should be the tension in the string if it is to vibrate in four loops ?

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20. Standing waves are producedin a rubber tube $12m$ long . If the tube vibrates in five segmens and the velocity of the wave is $480m/s$, what is (a) the wave length of the waves (b) the frequency of the wave ?

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21. If the lengths of the first and second resonating air columns are $16.5cm$ and $51.5cm$ respectively with a tuning fork of frequency $512Hz$, calculate the velocity of sound in air

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22. Two coherent sources are at distances $x_1 = 0.2m$ and $x_2 = 0.08m$ from a point. Consider the intensity of resultant wave at that point if the frequency of each wave is $f = 400Hz$ and velocity of wave in the medium is $V = 192m/s$

The intensity of each wave is $I_0 = 60W/m^2$

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23. The frequency of tuning fork 'A' is $250Hz$. It produces 6 beats/sec, when sounded together

with another tunning fork B. If its arms are loaded with wax then it produces 4 beats/sec. Find the frequency of tuning fork B.

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24. A tuning fork of frequency of $512Hz$ when sounded with unknown tunning fork produces 5 beats/sec. If arms of the unknown fork are filed then it produces only 3 beats/sec. Find the frequency of unknown tunning fork.

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25. If two sound waves, $y_1 = 0.3\sin 596\pi[t - x/330]$ and $y_2 = 0.5\sin 640\pi[t - x/330]$ are superposed, what will be the (a) frequency of resultant wave (b) frequency at which the amplitude of resultant waves varies (c) Frequency at which beats are produced. Find also the ratio of maximum and minimum intensities of beats

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26. When a train is approaching the observer, the frequency of the whistle is 100 cps. When it has passed observer, it is 50 cps. Calculate the frequncy when the observer moves with the train.

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27. A car approaching a crossing C at a speed of $20 m/s$ sounds a horn of frequency $500 H_Z$ when $80 m$ from the crossing . Speed of sound in air is $330m/s$. What frequency is heard by an observer (at rest) $60m$ from the crossing on the straight road which crosses car road at right angles ?

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28. A whistle of frequency $540H_Z$ rotates in a circle of radius $2m$at a linear speed of $30m/s$. What is the lowest and highest frequency heard by an observer a long distance away at rest with respect to the centre of circle ? Take speed of sound of sound in air as $330m/s$. Can the apparent frequency be ever equal to actual ?

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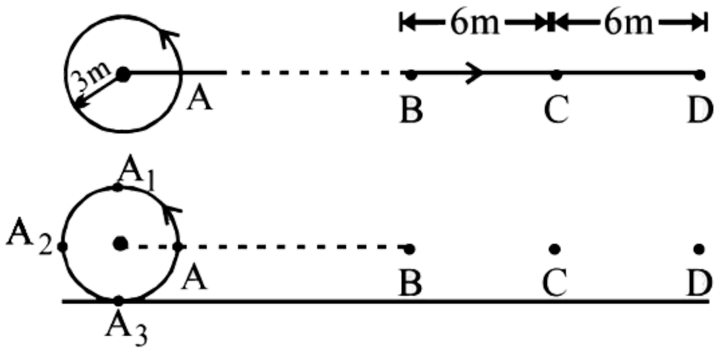
29. A source of sound is moving along a circular orbit of radius $3meter$ with an angular velocity of $10rad/s$. A sound detector located far away from the source is executing linear simple harmonic motion along the line BD with an amplitude $BC = CD = 6meters$. The frequency of oscillation of the detector is $\frac{5}{\pi}$ per second. The source is at the point A when the detector is at the point B. If the source emits a continuous sound wave of frequency $340Hz$, Find the maximum and the minimum frequencies recorded by the detector.



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30. The loudness level of ordinary conversation is $60dB$. Find the intensity of the ordinary conservation.

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Evaluate yourself-1

1. An observer standing at the sea coast observes $54 waves$ reaching the coast per minute. If the wavelength of a wave is $10m$, its speed is :

A. $90m/s$

B. $90cm/s$

C. $9m/s$

D. $900m/s$

Answer: C

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2. Which of the following statements is correct ?

A. Both sound and light waves in air are transverse

B. Both sound and light waves in air longitudinal

C. Sound waves in air are transverse while light longitudinal

D. Sound waves in air are longitudinal while light waves are transverse

Answer: D

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3. A student sees a jet plane flying from east to west. When the jet is seen just above his head, the sound of jet appears to reach him making angle of 60° with the horizontal from the east. If the velocity of the sound is V, then that of the jet plane is

A. $2V$

B. $\left(\frac{\sqrt{3}}{2}\right)V$

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

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

Answer: D

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

A. $1:\sqrt{2}$

B. $\sqrt{2}:1$

C. $1:2$

D. $2:1$

Answer: A

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5. A metal wire is held at the two ends of rigid supports at $20^{\circ}C$, the wire is just taut. The speed of transverse wave in this wire at $25^{\circ}C$ will be $(\alpha = 16 \times 10^{-6}/C, Y = 9 \times 10^{11} N/m^2,$ density of metal $= 5gm/c.c)$

A. $120ms^{-1}$

B. $12ms^{-1}$

C. $240ms^{-1}$

D. $1200ms^{-1}$

Answer: A

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6. Wave of frequency 500 Hz has a phase velocity $360m/s$. The phase difference between two displacement at a certain point at time $10^{-3}s$ apart will be

A. π radian

B. $\pi/2$ radian

C. $\pi/4$ radian

D. 2π radian

Answer: B

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7. The wavelength of infrasonics in air is of the order of

A. $10^{0}m$

B. $10^{3}m$

C. $10^{-1}m$

D. $10^{-2}m$

Answer: A

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8. If the bulk modulus of water is 2100 M Pa, what is the speed of sound in water ?

A. $1450m/s$

B. $2100m/s$

C. $0.21m/s$

D. $21m/s$

Answer: B

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9. A sound wave having a frequency of 500 Hz travels with a velocity of 360 m/s. What is the distance between two particles on this wave, who have a phase difference of 60° ?

A. 0.72 metre

B. 0.12 metre

C. 0.18 metre

D. 0.36 metre

Answer: D

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10. A sound wave is passing through air column in the form of compression and rerefactions. In consecutive compressions and rerefactions.

A. Bulk modulus of air oscillates

B. Density remains constant

C. Boyle's law is obeyed

D. total amount of heat remains constant

Answer: D

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11. Which not correctly matched

A. Light tranverse wave

B. Sound Longitudinal mechanical wave

C. Light Progressive wave

D. Sound Longitudinal non-mechanical wave

Answer: D

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12. A string of linear density 0.2kg/m is stretched with a force of 500 N. If a transverse wave of wavelength 4m and amplitude $(1/\pi)$ metre is travelling along it, then the speed of the wave will be

A. $50cm/s$

B. $12.5m/s$

C. $62.5m/s$

D. $2500m/s$

Answer: A

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Evaluate yourself-2

1. The relation between phase difference and path difference is

A. $\Delta\phi = \frac{2\pi}{\lambda}\Delta x$

B. $\Delta\phi = 2\pi\lambda\Delta x$

C. $\Delta\phi = \frac{2\pi\lambda}{\Delta r}$

D. $\Delta\phi = \frac{\pi}{\lambda}\Delta r$

Answer: A

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2. If the equation of progressive wave is given by $y = 4\sin\pi\left[\frac{t}{5} - \frac{x}{9} + \frac{\pi}{6}\right]$ then, which of the following is correct ? (Assume SI units)

A. $v = 5cm/\sec$

B. $\lambda = 18m$

C. $A = 0.04cm$

D. $f = 50Hz$

Answer: B

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3. Write down the equation for a wave propagating with velocity $330m/s$ and having frequency 110Hz. The amplitude is 0.05m.`

A. $y = 0.05\sin 2\pi\left[110t + \frac{x}{3}\right]$

B. $y = 0.05\sin 2\pi\left[110t - \frac{x}{3}\right]$

C. $y = 0.05\sin 2\pi\left[110t \pm \frac{x}{3}\right]$

D. $y = 0.05\sin[110t - 330x]$

Answer: C

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4. A travelling wave in the gas along the positive x-direction has an amplitude of $2cm$, velocity $45m/s$ and frequency $75Hz$. Particle acceleration after an interval of 3 sec at a distance of $135cm$ from the origin is

A. $0.44 \times 10^{2} cm / s^{2}$

B. $4.4 \times 10^{5} cm / s^{2}$

C. $4.4 \times 10^{3} cm / s^{2}$

D. $44 \times 10^{5} cm / s^{2}$

Answer: B

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5. The equation of a plane progressive wave is given by $y = 5\cos\left(200t - \frac{\pi}{150}x\right)$ where x and y in cm and t is in second. The wavelength of the wave is

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6. A 5.5 m length of string has a mass of 0.035 kg. If the tension in the string is 77 N the speed of a wave on the string is

A. $110ms^{-1}$

B. $165ms^{-1}$

C. $77ms^{-1}$

D. $102ms^{-1}$

Answer: C

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7. The velocity of sound in air is independent of changes is

A. Pressure

B. Density

C. Temperature

D. Humidity

Answer: A

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8. Amongst following media, which is rarest for sound waves

A. Vacuum

B. Air

C. Water

D. Steel

Answer: D

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9. Which of the following is incorrect ?

A. Frequency of waves doesn't changes with change in medium

B. Velocity of transverse waves in a stretched string is independent of length of string it is clamped horizontally

C. For a rope suspended vertically velocity of transverse pulse produced at lower end, increases as it moves up

D. Velocity of sound decreases with increase in humidity in air

Answer: D

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Evaluate yourself-3

1. A stretched wire of length $114 cm$ is divided into three segments whose frequencies are in the ratio $1:3:4$, the lengths of the segments must be in the ratio :

A. $18:24:72$

B. $24:72:18$

C. $24:18:72$

D. $72:24:18$

Answer: D

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

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

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

C. $256 \times \frac{22}{40}$

D. $256 \times \frac{40}{22}$

Answer: B

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3. A hollow metallic tube of length L and closed at one end produce resonance with a tuning fork of frequency n. The entire tube is then heated carefully so that at equilibrium temperature its length changes by l. If the change in velocity V of sound is v, the resonance will now produced by tuning fork of frequency :-

A. $\dfrac{(V + v)}{4(L + l)}$

B. $\dfrac{(V - v)}{4(L - l)}$

C. $\dfrac{(V + v)}{4(L - l)}$

D. $\dfrac{(V - v)}{4(L + l)}$

Answer: A

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4. An open pipe is suddenly closed at one end with the result that the frequency of third harmonic of the closed pipe is found to be higher by $100 Hz$ then the fundamental frequency of the open pipe. The fundamental frequency of the open pipe is

A. $200 Hz$

B. $300 Hz$

C. $240 Hz$

D. $480 Hz$

Answer: A

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5. The equation $y=4\cos\left(\frac{2\pi x}{50}\right)\sin(100\pi t)$ represents a stationary wave, where x and y are in cm, and 't' is in s. Then a node occurs at a distance of origin

A. $12.5cm$

B. $50cm$

C. $20cm$

D. $\frac{100}{2\pi}cm$

Answer: A

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6. Standing waves are produced by superposition of two waves

$y_1 = 0.05\sin(3\pi t - 2x)$,

$y_2 = 0.05\sin(3\pi t + 2x)$

where x and y are measured in metre and t in second. Find the amplitude of the particle at x = 0.5m.

A. $0.054m$

B. $0.54m$

C. $0.45m$

D. $0.95m$

Answer: A

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7. In melde's experiment, when tension in the string is 100gm wt and the tuning fork vibrates transversely , then the number of loops are 4. then the string in turned through 90°, so that is vibrates longitudinally. What is the extra tension required to form one loop in the string ?

A. $300gm$

B. $200gm$

C. $100gm$

D. $50gm$

Answer: A

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8. A particle executes simple harmonic motion with a frequency. (f). The frequency with which its kinetic energy oscillates is.

A. f

B. $2f$

C. $4f$

D. $f/2$

Answer: B

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9. Two oscillations $x_1 = A\sin wt$ and $x_2 = A\cos wt$ superimpose at right angles in x and y axis respectively. What will be the resultant wave form ?

A. ellipse

B. straight line

C. circle

D. parabola

Answer: C

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10. When a sound wave goes from one medium to another, the quantity that remains unchanged is :

A. Frequency

B. Amplitude

C. Wavelength

D. Speed

Answer: A

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Evaluate yourself-4

1. If two tuning fork A and B are sounded together they produce 4 beats per second. A is then slightly loaded with wax, they produce 2 beats when sounded again. The frequency of A is 256. The frequency of B will be

A. $250Hz$

B. $252Hz$

C. $260Hz$

D. $262Hz$

Answer: B

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2. A tuning fork gives 4 beats with 50 cm length of a sonometer wire. If the length of the wire is shortened by 1 cm, the number of beats is still the same. The frequency of the fork is

A. 404

B. 400

C. 396

D. 384

Answer: C

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3. When two waves of aimost equal frequenies n_1 and n_2 are produced simultaneously, then the time interval between successive mixima is

A. $\frac{1}{n_1 - n_2}$

B. $\frac{1}{n_1} - \frac{1}{n_2}$

C. $\dfrac{1}{n_1} + \dfrac{1}{n_2}$

D. $\dfrac{1}{n_1 + n_2}$

Answer: A

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4. Two sinusoidal plane waves of same frequency having intensities I_0 and $4I_0$ are travelling in the same direction. The resultant intensity at a point at which waves meet with a phase difference of zero radian is

A. I_0

B. $5I_0$

C. $9I_0$

D. $3I_0$

Answer: C

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5. Two periodic waves of intensities I_1 and I_2 pass through a region at the same time in the same direction. The sum of the maximum and minimum intensities is:

A. $2\left(I_1 + I_2\right)$

B. $I_1 + I_2$

C. $\left(\sqrt{I_1} + \sqrt{I_2}\right)^2$

D. $\left(\sqrt{I_1} - \sqrt{I_2}\right)^2$

Answer: A

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6. Water waves are

A. Longitudinal

B. Transverse

C. Both (1) and (2)

D. None of these

Answer: C

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7. A tuning fork of frequency 200Hz is in unison with a sonometer wire . The number of beats heard per second when the tension is increased by 1% will be

A. 1

B. 2

C. 4

D. 1/2

Answer: A

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8. If the pressure amplitude in a sound wave is tripled, then by what factor the intensity of sound wave is increased?

A. 9

B. 2

C. 6

D. $\sqrt{3}$

Answer: A

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Evaluate yourself-5

1. A rocket is going away from the earth at a speed 0.2 c , where c = speed of light. It emits a signal of frequency $4 \times 10^{7} Hz$. What will be the frequency observed by an observer on the earth

A. $3.2 \times 10^{7} Hz$

B. $4.8 \times 10^{7} Hz$

C. $4.0 \times 10^7 Hz$

D. $5.3 \times 10^7 Hz$

Answer: B

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2. A bus is moving with a velocity of $5ms^{-1}$ towards a huge wall. The driver sound a horn of frequency 165 Hz. If the speed of sound in air is $335ms^{-1}$, the number of beats heard per second by a passenger inside the bus will be

A. 3

B. 4

C. 5

D. 6

Answer: C

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3. When a train approaches a stationary observer, the apparent frequency of the whistle is n' and when the same train recedes away from the observer, the apparent frequency is n. Then the apperent frquency n when the observer sitting in the train is :

A. $n = \dfrac{n' + n''}{2}$

B. $n = \sqrt{n' n''}$

C. $n = \dfrac{2n' n''}{n' + n''}$

D. $n = \dfrac{2n' n''}{n' - n''}$

Answer: C

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4. Velocity of sound is v. Source and observer move towards each other with velocities V_s and V_0 respectively. Wind is blowing with a velocityv_m in the direction opposite to the propagation of sound, n is the frequency of the sound. The apparent frequency of the sound heard by the observer is :-

A. $\left(\frac{V + V_m - V_0}{V + V_m + V_s}\right)n$

B. $\left(\frac{V - V_m + V_0}{V - V_m + V_s}\right)n$

C. $\left(\frac{V + V_m - V_0}{V - V_m - V_s}\right)n$

D. $\left(\frac{V - V_m + V_0}{V - V_m - V_s}\right)n$

Answer: D

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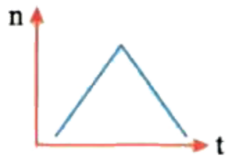
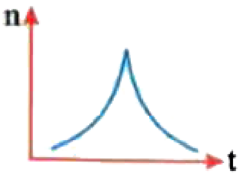
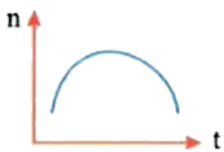
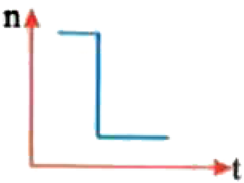
5. A railway engine whistling at a constant frequency moves with a constant speed. It goes past a stationary observer standing beside the railway track. The frequency (n) of the sound heard by the observer is plotted agains time (t). Which of the following best represents the resulting curve?

A. 

B. 

C. 

D. 

Answer: D

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6. The Kundt's tube experiment shows that the sound waves are

A. Longitudinal in nature

B. Transverse in nature

C. Electromagnetic waves

D. Polarised waves

Answer: A

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7. A tuning fork of unknown frequency gives 4beats with a tuning fork of frequency 310 Hz. It gives the same number of beats on filing. Find the unknown frequency.

A. 258

B. 254

C. 250

D. Can't be determined

Answer: A

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C.U.Q

1. The sound waves that can propagate in a metal bar may be

A. Longitudinal

B. Transverse

C. Torsional

D. Either longitudinal or transverse

Answer: D

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2. When a waves is travelling in a medium , in that process, the following is/are transporting from one particle to other

A. energy

B. momentum

C. both 1 & 2

D. length

Answer: C

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3. A plane progressive wave cannot be represented by

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

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

C. $y = a\sin.\ \frac{2\pi}{\lambda}(Vt - + x)$

D. $y = A\log x + B\log x$

Answer: D

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4. The speed of wave of time period T and propagation constant K is

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

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

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

D. $\frac{T}{K}$

Answer: A

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5. What is the phase difference between the incident and reflected wave when the wave is reflected by a rigid boundary.

A. 0

B. π

C. 3π

D. 2π

Answer: B

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6. A sound wave may be considered either as a displacement wave or as a pressure wave . When reflection takes place from as a rigid wall , what phase change do you except in its displacement representation and in its pressure representation?

A. 0

B. π

C. 3π

D. $\pi/2$

Answer: A

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7. During propagation of longitudinal plane wave in a medium the two particles separated by a distance equivalent to one wavelength at an instant will be/have

A. in phase, same displacement

B. in phase, different displacement

C. different phase, same displacement

D. different phase, different displacement

Answer: A

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8. The equation of a progressive wave is $Y = a\sin(\omega t - kx)$, then the velocity of the wave is

A. $k\omega$

B. k/ω

C. ω/k

D. $a\omega$

Answer: C

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9. When a progressive wave is propagating in a medium, at a given instant, two particles which are separated by three wave lengths will have.....

A. Different displacement in same direction

B. Different displacement in opposite direction

C. Same displacement in opposite direction

D. Same displacement in same direction

Answer: D

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10. Which of the following represents progressive wave equation

A. $y = e^{\left(x^2 - t^2\right)}$

B. $y = A\log kx$

C. $y = A\log(kx - \omega t)^2$

D. $y = \dfrac{1}{1 + \left(x^2 - t\right)}$

Answer: C

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11. Phase difference between a particle at a compre-ssion and a particle at the next rarefaction is

A. Zero

B. $\pi/2$

C. π

D. $\pi/4$

Answer: C

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12. One similarity between sound and light waves is that

A. both can propagat in vacuum

B. both have same speed

C. both can show polarization

D. both can show interference

Answer: D

Watch Video Solution

13. When a body is undergoing undamped vibration, the physical quantity that remains constant is

A. amplitude

B. velocity

C. acceleration

D. phase

Answer: A

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14. The slope of a transversely vibrating string at any point on it is numerically equal to

A. The ratio of the particle speed at that point to the wave speed in the string

B. The ratio of the wave speed in the string to the particle speed at that point

C. One

D. Zero

Answer: A

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15. A metal string is fixed between rigid supports. It is initially at negligible tensin. Its Young modulus is Y, density ρ and coefficient of thermal expansion is α. If it is now cooled through a temperature $= t$, transverse waves will move along it with speed

A. $\sqrt{\frac{Y\alpha t}{\rho}}$

B. $Y\sqrt{\frac{\alpha t}{\rho}}$

C. $\alpha\sqrt{\frac{Yt}{\rho}}$

D. $t\sqrt{\frac{\rho}{Y\alpha}}$

Answer: A

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16. If in an experimental determination of the velocity of sound using a Kundt's tube, standing waves are set up in the metallic rod as well as in the rigid tube containing air, then both the waves have the same

A. Amplitude

B. Frequencies

C. Wavelengths

D. Particle velocities

Answer: B

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17. The phenomena arising due to the superposition of waves is/are

A. beats

B. Stationary Waves

C. Lissajous figures

D. All of these

Answer: D

Watch Video Solution

18. Which of the following represents a standing wave ?

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

B. $y = Ae^{-bx}\sin(\omega t - kx + \alpha)$

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

D. $y = (ax + b)\sin(\omega t - kx)$

Answer: C

Watch Video Solution

19. The interference phenomenon can take place

A. in transverse wave only

B. in longitudinal wave only

C. in electromagnetic waves only

D. in all the above waves

Answer: D

View Text Solution

20. For superposition of two waves, the following is correct

A. they must have the same frequency and wavelength

B. they must have equal frequencies but may have unequal wavelengths

C. they must have the same wave-length, but may have different frequencies

D. they may have different wavelength and different frequencies

Answer: D

Watch Video Solution

21. At a certain instant a stationary transverse wave is found to have maximum kinetic energy. The appearance of string at that instant is

A. sinusoidal shape with amplitude $A/3$

B. sinusoidal shape with amplitude $A/2$

C. sinusoidal shape with amplitude A

D. straight line

Answer: C

Watch Video Solution

22. When stationary waves are set up, pick out the correct statement from the following

A. all the particles in the medium are in the same phase of vibration at all times and distances

B. the particles with an interval between two consecutive nodes are in phase, but the particles in two such consecutive antinodes are of opposite phase

C. the phase lag along the path of the wave increases as the distance from the source increases

D. only antinodes are in same phase

Answer: B

View Text Solution

23. In a stationary wave along a string the strain is

A. zero at the antinodes

B. maximum at the antinodes

C. zero at the nodes

D. maximum at the nodes

Answer: D

Watch Video Solution

24. In a stationary wave

A. phase is same at all points in a loop

B. amplitude is same at all points

C. energy is constant at all points

D. temperature is same at all points

Answer: A

Watch Video Solution

25. A wave is represented by an equation,

$Y = A\cos kx \sin \omega t$, then

A. it is a progresive wave with amplitude A

B. it is a progresive wave with amplitude A

$\cos kx$

C. it is a stationary wave with amplitude A

D. it is a stationary wave with amplitude A

$\cos kx$

Answer: D

Watch Video Solution

26. In a stationary wave

A. pressure change is maximum at nodes

B. pressure change is maximum at anitnodes

C. pressure change is minimum at nodes

D. amplitude is zero at all points

Answer: A

View Text Solution

27. A wire fixed at both ends in sonometer experiment is vibrating in the third overtone. There are

A. two nodes, two antinodes

B. three nodes, three antinodes

C. four nodes, three antinodes

D. five nodes, four antinodes

Answer: D

Watch Video Solution

28. λ is maximum wavelength of a transverse wave that travels along a stretched wire whose two ends are fixed. The length of that wire is

A. 2λ

B. λ

C. $\lambda/2$

D. $3\lambda/2$

Answer: C

View Text Solution

29. A sonometer wire of density ρ and radius r is held between two bridges at a distance L apart . Tension in the wire is T. then the fundamental frequency of the wire will be

A. $\frac{1}{2L}\sqrt{\frac{\pi a^2}{T\rho}}$

B. $\frac{1}{2L}\sqrt{\frac{T\rho}{\pi a^2}}$

C. $\frac{1}{2L}\sqrt{\frac{T}{\pi a^2}}$

D. $\frac{1}{2L}\sqrt{\frac{T}{\pi a^2 \rho}}$

Answer: D

Watch Video Solution

30. For a stretched string of given length,the tension 'T' is plotted on the X-axis and the frequency 'f' on the Y- axis.The graph is rectangular hyperbola straight line through the origin

A. rectangular hyperbola

B. straight line through the origin

C. parabola

D. straight line not through the origin

Answer: C

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31. The equation of a stationary wave in a medium is given as $y = \sin\omega t \cos kx$. The length of a loop in fundamental mode is

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

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

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

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

Answer: B

Watch Video Solution

32. A stretched string of length l, fixed at both ends can sustain stationary waves of wavelength λ given by

A. $\lambda = \dfrac{l^2}{2p}$

B. $\lambda = \dfrac{p^2}{2l}$

C. $\lambda = 2lp$

D. $\lambda = \dfrac{2l}{p}$

Answer: D

Watch Video Solution

33. A knife-edge divides a sonometer wire into two parts. The fundamental frequencies of the two parts are n_1 and n_2. The fundamental frequency of the sonometer wire when the knife-edge is removed will be

A. $n_1 + n_2$

B. $\frac{1}{2}(n_1 + n_2)$

C. $\sqrt{n_1 n_2}$

D. $\frac{n_1 n_2}{n_1 + n_2}$

Answer: D

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34. According to Laplace correction, the propagation of sound in gas takes place under

A. isothermal condition

B. isobaric condition

C. isochoric condition

D. adiabatic condition

Answer: D

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35. The velocity of sound is not affected by change in

A. temperature

B. medium

C. pressure

D. wavelength

Answer: C

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36. Velocity of sound in air is

A. decreases with increase in pressure

B. may increase on decrease with pressure

C. it independent of the variation in pressure

D. varies directly as the square root of pressure

Answer: C

Watch Video Solution

37. If the temperature of the atmosphere is increased the following character of the sound wave is effected

A. amplitude

B. frequency

C. velocity

D. wavelength

Answer: C

Watch Video Solution

38. The graph between the $\left(velocity^2\right)$ and temperature T of a gas is

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39. A closed pipe has certain frequency. Now its length is halved. Considering the end correction, its frequency will now become

A. double

B. more than double

C. less than double

D. four times

Answer: C

Watch Video Solution

40. The fundamental frequency of a closed organ pipe is 'n' . If its length is doubled then frequency will become (neglecting end correction)

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

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

C. n

D. $2n$

Answer: A

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41. v31

A. $\lambda = l$

B. $\lambda = 2l$

C. $\lambda = 4l$

D. $\lambda = 3l$

Answer: B

Watch Video Solution

42. In the case of closed end organ pipe

A. the maximum possible wavelength is same as that of open end organ pipe

B. the maximum possible wavelength is less than that of open end organ pipe

C. the maximum possible wavelength may be less than that of open end organ pipe

D. the maximum possible wavelength is greater than that of open end organ pipe

Answer: D

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43. In the case of standing waves in organ pipe, the value of $\frac{\delta y}{\delta x}$ at the open end is

A. > 0

B. < 0

C. $= 0$

D. $= 10$

Answer: C

View Text Solution

44. The harmonics formed in air column in an organ pipe closed at one end are

A. only odd

B. only even

C. both odd and even

D. niether odd nor even

Answer: A

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45. A tube with both ends closed has same set of natural frequency as

A. one end closed organ pipe

B. both end open organ pipe

C. vibratory string fixed at both ends

D. vibratory string fixed at one end

Answer: B

Watch Video Solution

46. The frequency of the sound emitted by an organ pipe will increase if the air in it is replaced by

(a) hot air (b) moist air (c) hydrogen

A. a is true

B. a, b are true

C. b, c are true

D. a, b, c are true

Answer: D

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47. An empty vessel is partially filled with water, then the frequency of vibration of air column in the vessel

A. increase

B. decrease

C. remains unchanged

D. insufficent data

Answer: A

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48. End correction in a closed organ pipe of diameter 'd' is

A. $0.6d$

B. $1.2d$

C. $0.3d$

D. $2.4d$

Answer: C

View Text Solution

49. If oil of density higher than that of water is used in place of water in a resonance tube its frequency will be

A. increase

B. decrease

C. remain the same

D. depend upon the density of the material of tube

Answer: C

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

A. $1:2:3$

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

C. $1:3:5$

D. $5:3:1$

Answer: B

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51. In closed pipes, the positions of antinodes are obtained at –

A. $\frac{\lambda}{4}, \frac{3\lambda}{4}, \frac{5\lambda}{4}$

B. $0, \frac{\lambda}{2}, \lambda$

C. $\lambda, 2\lambda, 3\lambda$

D. $2\lambda, 4\lambda, 6\lambda$

Answer: B

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52. An open pipe of length l vibrates in fundamental mode. The pressure variation is maximum at

A. $1/4$ from ends

B. the middle of pipe

C. the ends of pipe

D. at $1/8$ from ends of pipe

Answer: A

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53. Beats are produced by the superimposition of two waves of nearly equal frequencies. Which of the following statements is CORRECT?

A. all particles of the medium vibrate simple harmonically with frequency equal to the difference between the frequencies of component waves

B. the frequency of beats changes with the location of the observer

C. the frequency of beats changes with time

D. amplitude of vibration of particle at any point changes simple harmonically with frequency equal to one half of the difference between the component waves

Answer: D

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54. When beats are formed by two waves of frequencies n_1 and n_2 the amplitude varies with frequency equal to

A. n_1 - n_2

B. $2(n_1 - n_2)$

C. $(n_1 - n_2)2$

D. $(n_1 + n_2)2$

Answer: C

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55. Two wires are producing fundamental notes of the same frequency. Change in which of the following factors of one wire will not produce beats between them

A. stretching force

B. diameter of the wire

C. material of the wire

D. amplitude of the vibrations

Answer: D

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56. Beats are the result of

A. diffraction

B. destructive interference

C. constructive and destructive interference

D. superposition of two waves of nearly equal frequencies

Answer: D

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57. To hear beats, it is essential that the two sound waves in air should

A. be travelling in opposite directions

B. be travelling in the same directions

C. have slightly different amplitude

D. have slightly different wavelengths

Answer: D

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58. When the beats are produced by vibration of two tunning forks of nearly equal frequencies then the velocity of propagation of beats

A. less than that of sound

B. depend upon the relative frequency

C. more than that of sound

D. equal to that of sound

Answer: D

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59. A certain number of beats are heard when two tuning forks of natural frequencies n_1 and n_2 are sounded together. The number of beats heard when one of the fork is loaded

A. increases

B. decreases

C. remains same

D. may increase or decrease

Answer: D

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60. The frequency of sound reaching a stationery listener behind a moving source is

A. lower than source frequency

B. higher than source frequency

C. zero

D. same as the frequency of the source

Answer: A

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61. Red shift means

A. Source is going away from observer

B. Source is coming towards observer

C. There is no relative motion between observer & source

D. None of these

Answer: A

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62. Doppler's effect in sound is due to

A. motion of source

B. motion of observer

C. relative motion of source and observer

D. None of the above

Answer: C

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63. Doppler shift in frequency does not depend upon

A. the frequency of wave produced

B. the speed of the source

C. distance between source and observer

D. the speed of the observer

Answer: C

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64. An observer is moving away from a source at rest. The pitch of the note heard by the observer is less because

A. the pitch of the source decreases

B. the velocity of sound in air increases

C. wave length of the wave becomes will

D. wavelength of the wave remains unchanged but observer receives less number of waves

Answer: D

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65. Doppler effect is not applicable

A. sound Waves

B. light Waves

C. radio Waves

D. matter Waves

Answer: D

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66. In Doppler effect, when a source moves towards a stationery observer, the apparent increase in frequency is due to

A. increase in wavelength of sound received by observer

B. decrease in wavelength of sound received by observer

C. increase in number of waves received by observer in one sound

D. decrease in number of waves received by ovserver in one sound

Answer: B

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67. When a source moves away from stationary observer with velocity v then apparent change in frequency is Δn_1. When an observer approaches the stationary source with same velocity v then change in frequency is Δn_2 then

A. $\Delta n_1 = \Delta n_2$

B. $\Delta n_1 > \Delta n_2$

C. $\Delta n_1 < \Delta n_2$

D. $\dfrac{\Delta n_1}{\Delta n_2} < 1$

Answer: C

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68. A source of sound moves towards a stationary listener. The apparent pitch of the sound is found to be higher than the actual value. This happens because

A. wavelength of sound waves decreases

B. wavelength of sound waves increases

C. the number of waves received by the listener increases

D. the number of waves received by the listener decreases

Answer: A

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Exercise-I (C.W)

1. Which of the following represents a progressive wave

A. $y = A\sin\left(\left(kx^3 - \omega t^2\right)2\right)$

B. $y = e^{(kx - \omega t)}$

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

D. both 2 and 3

Answer: D

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2. The equation of progressive wave is $y = 0.01\sin(100t - x)$ where x, y are in meter and t in second, then

(a) Velocity of wave is $50m/s$

(b) Maximum velocity of particle is $1m/s$

(c) Wave length of wave is 2π meter

A. only a, c are true

B. only a, b are true

C. only b, c are true

D. a, b, c are true

Answer: C

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

A. $\frac{A}{2}$, $2n$ and $\frac{\lambda}{2}$

B. $\frac{A}{2}$, $2n$ and λ

C. A, $2n$ and 2λ

D. A, n and λ

Answer: A

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4. A transverse wave is derscried by the equation $y = y_0 \sin 2\pi \left(ft - \frac{x}{\lambda}\right)$. The maximum particle velocity is equal to four times the wave velocity if :-

A. $\lambda = \pi Y_0 / 4$

B. $\lambda = \pi Y_0 / 2$

C. $\lambda = \pi Y_0$

D. $\lambda = 2\pi Y_0$

Answer: B

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5. Two simple harmonic are represented by the equation

$$y_1 = 0.1\sin\left(100\pi + \frac{\pi}{3}\right) \text{ and } y_2 = 0.1\cos\pi t.$$

The phase difference of the velocity of particle 1 with respect to the velocity of particle 2 is.

A. $-\frac{\pi}{6}$

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

C. $-\frac{\pi}{3}$

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

Answer: A

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6. A transverse wave along a string is given by

$$y = 2\sin\left(2\pi(3t - x) + \frac{\pi}{4}\right)$$

where x and y are in cm and t in second. Find acceleration of a particle located at x = 4 cm at t = 1s.

A. $36\sqrt{2}\pi^2 cm/s^2$

B. $36\pi^2 cm/s^2$

C. $-36\sqrt{2}\pi^2 cm/s^2$

D. $-36\pi^2 cm/s^2$

Answer: C

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7. The frequency of a fork is $500Hz$. Velocity of sound in air is $350ms^{-1}$. The distance through which sound travel by the time the fork makes 125 vibrations is

A. $87.5m$

B. $700m$

C. $1400m$

D. $1.75m$

Answer: A

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8. The velocity of sound waves in air is $330m/s$.

For a particluar sound in air, a path difference of $40cm$ is equivalent to a phase difference of 1.6π. The frequency of this wave is

A. $165Hz$

B. $150Hz$

C. $660Hz$

D. $330Hz$

Answer: C

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9. A wave has a frequency of $120Hz$. Two points at a distance $9m$ apart have a phase difference of 1080°. The velocity of the wave is

A. $340m/s$

B. $300m/s$

C. $330m/s$

D. $360m/s$

Answer: D

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10. A source of frequency $500Hz$ emits waves of wavelength $0.2m$. How long does it take to travel $300m$?

A. 70 sec

B. 60 sec

C. 12 sec

D. 3 sec

Answer: D

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

$y = \dfrac{1}{1 + x^2}$ at $t = 0$ and $y = \dfrac{1}{1 + (x - 1)^2}$ 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. $2ms^{-1}$

B. $0.5ms^{-1}$

C. $3ms^{-1}$

D. $1ms^{-1}$

Answer: B

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12. A wave of angular frequency ω propagates so that a certain phase of oscillation moves along x-axis, y-axis, z-axis with speeds $c_1 c_2$ and c_3 respectively.

A. $\dfrac{\omega}{\sqrt{c_1^2 + c_2^2 + c_3^2}}\left(\hat{i} + \hat{j} + \hat{k}\right)$

B. $\frac{\omega}{c_1}\hat{i} + \frac{\omega}{c_2}\hat{j} + \frac{\omega}{c_3}\hat{k}$

C. $\left(\omega\hat{i} + \omega\hat{j} + \omega\hat{k}\right)\frac{1}{c}$

D. $\frac{\omega}{\left(c_1 + c_2 + c_3\right)}\left(\hat{i} + \hat{j} + \hat{k}\right)$

Answer: B

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13. A travelling wave has the frequency υ and the particle displacement amplitude A. For the wave the particle velocity amplitude is

.... and the particle acceleration amplitude is ....

A. $1 : \omega^2$

B. $1 : \sqrt{\omega}$

C. $1 : \omega$

D. $1 : \omega^3$

Answer: C

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14. If Young's modulus of the material of a rod is Y and density is ρ then time taken by sound wave to travel l length from bottom is

A. $l\sqrt{\frac{\rho}{Y}}$

B. $l\sqrt{\frac{Y}{\rho}}$

C. $\frac{1}{l}\sqrt{\frac{Y}{\rho}}$

D. $\frac{1}{l}\sqrt{\frac{\rho}{Y}}$

Answer: A

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15. v20.1

A. $100ms^{-1}$

B. $141.1ms^{-1}$

C. $200ms^{-1}$

D. $282.2ms^{-1}$

Answer: B

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

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

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

A. 0.24

B. 0.48

C. 1.20

D. 1.80

Answer: B

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17. The extension in a string, obeying Hooke's law, is x. The speed of sound in the stretched string is v. If the extension in the string is increased to $1.5x$, the speed of sound will be :-

A. $1.22V$

B. $0.61V$

C. $1.50V$

D. $0.75V$

Answer: A

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18. A uniform rope of length $12m$ and mass $6kg$ hangs vertically from a rigid support. A block of mass $2kg$ is attached to the free end of the rope. A transverse pulse of wavelength $0.06m$ is produced at the lower end of the rope.

What is the wavelength of the pulse when it reaches the top of the rope?

A. $0.06m$

B. $0.12m$

C. $0.24m$

D. $0.03m$

Answer: B

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19. A string of length l hangs freely from a rigid support. The time required by a transverse pulse to travel from bottom to half length of the string is

A. $\sqrt{lg}$

B. $\sqrt{\frac{l}{g}}$

C. $\sqrt{\frac{l}{2g}}$

D. $\sqrt{\frac{2l}{g}}$

Answer: C

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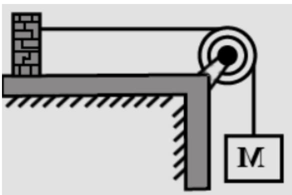
20. A transverse wave is passing through a light string shown in fig.The equation of wave is $y = A\sin(wt - kx)$ the area of cross-section of string A and density is ρ the hanging mass is



A. $A\omega$

B. $\frac{\omega}{kg}$

C. $\frac{\rho A\omega^2}{k^2 g}$

D. $\frac{k^2 g}{\omega}$

Answer: C

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21. The equation of a wave on a string of linear mass density $0.04 kgm^{-1}$ is given by

$$y = 0.02(m)\sin\left[2\pi\left(\frac{t}{0.04(s)} - \frac{x}{0.50(m)}\right)\right].$$

Then tension in the string is

A. $6.25N$

B. $4.0N$

C. 12.5

D. $0.5N$

Answer: A

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22. In (Q. 24.) the tension in string is T and the linear mass density of string is μ. The ratio of magnitude of maximum velocity of particle and the magnitude of maximum acceleration is

A. $\frac{1}{2\pi}\sqrt{\left(\frac{\mu l^2}{T}\right)}$

B. $2\pi\sqrt{\left(\frac{\mu l^2}{T}\right)}$

C. $\frac{1}{2\pi}\sqrt{\left(\frac{T}{\mu l^2}\right)}$

D. $\frac{1}{4\pi}\sqrt{\left(\frac{\mu l^2}{T}\right)}$

Answer: A

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23. The speed of sound in air is $332 m/s$ at NTP. What will be its value in hydrogen at NTP, if density of hydrogen at NTP is $1/16th$ that of air ?

A. $1238 m/s$

B. $1328 m/s$

C. $3218 m/s$

D. $2831 m/s$

Answer: B

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24. Calculate the ration of speed of sound in neon to that in water vapours at any temperature. Molecular weight on neon $= 2.02 \times 10^{-2} kg/mole$ and for water vapours, molecular weight is $1.8 \times 10^{-2} kg/mole$.

A. 0.155

B. 5.155

C. 1.055

D. 1.55

Answer: C

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25. The pressure of air increases by $100mm$ of Hg and the temperature decreases by $1^{\circ}C$. The change in the speed of sound in air at STP is $\left(V_0 = 333m/s\right)$

A. $61ms^{-1}$

B. $61mms^{-1}$

C. $61cms^{-1}$

D. $0.61cms^{-1}$

Answer: C

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26. The temperature at which the velocity of sound in oxygen will be same as that of nitrogen at $15^{\circ}C$ is

A. $561^{\circ}C$

B. $56.1^{\circ}C$

C. $5.61^{\circ}C$

D. $5.061^{\circ}C$

Answer: B

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27. The ratio of the speed of sound in nitrogen gas to that in helium gas, at 300K is

A. $\sqrt{2}:\sqrt{7}$

B. $1:\sqrt{7}$

C. $\sqrt{3}:5$

D. $\sqrt{6}:5$

Answer: C

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28. A pressure of $100kPa$ causes a decrease in volume water by 5×10^{-3} precent. The speed of sound in water is

A. $1414ms^{-1}$

B. $1000ms^{-1}$

C. $2000ms^{-1}$

D. $3000ms^{-1}$

Answer: A

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29. The speed of sound in hydrogen at STP is V. The speed of sound in a mixture containing 3

parts of hydrogen and 2 parts of oxygen at STP will be

A. $V/2$

B. $V/\sqrt{5}$

C. $\sqrt{7}V$

D. $V/\sqrt{7}$

Answer: D

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30. Calculate the velocity of sound in a mixture of two gases obtained by mixing m_1 and m_2 of them if the velocity of sound in them be C_1 and C_2. The atomicity of the two gases is the same.

A. $c = \sqrt{\frac{m_1c_1^2 + m_2c_2^2}{m_1 + m_2}}$

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

C. $c = \sqrt{\frac{m_2c_2 + m_1c_2}{m_1 + m_2}}$

D. $c = m_2\sqrt{\frac{c_2^2 + c_1^2}{m_1 + m_2}}$

Answer: A

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31. Two waves given by $y_1 = a\sin\omega t$ and $y_2 = a\sin(\omega t + \pi/2)$ reaching at a point superimpose. The resultant amplitude is

A. 0

B. $2a$

C. $a\sqrt{2}$

D. $\dfrac{a}{\sqrt{2}}$

Answer: C

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32. Two sound waves are represented by

$y_1 = \sin\omega t + \cos\omega t$ and $y_2 = \dfrac{\sqrt{3}}{2}\sin\omega t + \dfrac{1}{2}\cos\omega t.$

The ratio of their amplitude is

A. $1:1$

B. $\sqrt{3}:2$

C. $2:\sqrt{3}$

D. $\sqrt{2}:1$

Answer: D

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33. A standing wave, having 5 nodes and 4 antinodes is formed between two atoms having a distance 1.21Å between them. The wavelength of the standing wave is

A. 1.21Å

B. 2.42Å

C. 6.05Å

D. 0.605Å

Answer: D

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34. A tuning fork of frequency 480 Hz is used to vibrate a sonometer wire having naturl frequency 410 Hz. The wire wil vibrate with frequency

A. $410Hz$

B. $480Hz$

C. $820Hz$

D. $960Hz$

Answer: B

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35. When the streching force of a wire is increased by $2.5kg$, the frequency of the note emitted is changed in the ratio $3/2$. Calculate the original stretching force

A. $3kg$

B. $2kg$

C. $1.5kg$

D. $1kg$

Answer: B

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36. If f_1 and f_2 be the fundamental frequencies of the two segments into which a stretched string is divided by means of a bridge , then find the original fundamental frequency f of the complete string.

A. $f_1 f_2 = f[f_1 + f_2]$

B. $2f = f_1 + f_2$

C. $\sqrt{f} = \sqrt{f_1} + \sqrt{f_2}$

D. $\sqrt{f_1 f_2} = 2f$

Answer: A

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37. Stationary waves are produced in 10 m long stretched string. If the string vibrates in 5 segments and wave velocity 20 m/s then the frequency is :-

A. $2Hz$

B. $4Hz$

C. $5Hz$

D. $10Hz$

Answer: C

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38. The equation $y = 5\sin\left(\frac{\pi x}{25}\right)\cos(450t)$ represents the stationary wave in a vibrating sonometer wire, where x, y are in cm and t in sec. The distances of $2nd$ and $3rd$ nodes from one end are (in cm).

A. 50, 75

B. 25, 50

C. 15, 50

D. 20, 50

Answer: B

Watch Video Solution

39. v20

A. $5:3$

B. $5:2$

C. $2:5$

D. $3:5$

Answer: B

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40. If the length of a stretched string is shortened by 40% and the tension is increased by 44%, then the ratio of the final and initial fundamental frequencies is

A. $2:1$

B. $3:2$

C. $3:4$

D. $1:3$

Answer: A

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41. The fundamental frequency of a stretched string with a weight of $9kg$ is $289Hz$. The weight required to produce its octave is

A. $9kgwt$

B. $16kgwt$

C. $25kgwt$

D. $36kgwt$

Answer: D

Watch Video Solution

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

A. $2M$

B. $M/4$

C. $4M$

D. $M/2$

Answer: B

Watch Video Solution

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

A. $1:\sqrt{2}$

B. $\sqrt{2}:1$

C. $1:2$

D. $2:1$

Answer: D

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44. A string is stretched between fixed points separated by $75.0cm$. It is observed to have resonant frequencies of $420Hz$ and $315Hz$. There are no other resonant frequencies between these two. Then, the lowest resonant frequency for this string is

A. $105Hz$

B. $1.05Hz$

C. $1005Hz$

D. $10.5Hz$

Answer: A

Watch Video Solution

45. A sound wave with an amplitude of $3cm$ starts towards right from origin and gets reflected at a rigid wall after a second. If the velocity of the wave is $340 ms^{-1}$ and it has a wavelength of $2m$, the equations of incident and reflected waves respectively are :

A. $y = 3 \times 10^{-2} \sin\pi(340t - x)$,

$y = -3 \times 10^{-2} \sin\pi(340t + x)$ towards left

B. $y = 3 \times 10^{-2} \sin\pi(340t + x)$,

$y = -3 \times 10^{-2} \sin\pi(340t + x)$ towards left

C. $y = 3 \times 10^{-2} \sin\pi(340t - x)$,

$y = -3 \times 10^{-2} \sin\pi(340t - x)$ towards left

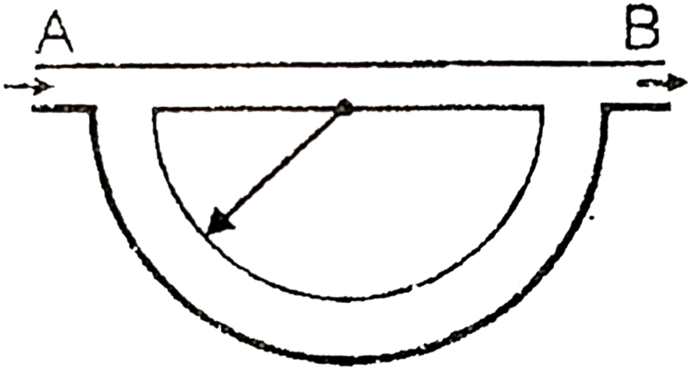
D. $y = 3 \times 10^{-2} \sin\pi(340t - x)$,

$y = 3 \times 10^{-2} \sin\pi(340t + x)$ towards left

Answer: A

Watch Video Solution

46. Sound signal is sent through a composite tube as shown in the figure. The radius if the semicircular portion of the tube r. Speed of sound in air is v. The source of sound is capable of giving vaied frequencies in the range of v_1 and v_2 (where $v_2 > v_1$). If n is an integer then frequency for maximum intensity is given by



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

B. $\frac{nV}{r(\pi - 2)}$

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

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

Answer: B

Watch Video Solution

47. Four simple harmonic vibrations

$y_1 = 8\sin\omega t$, $y_2 = 6\sin(\omega t + \pi/2)$,

$y_3 = 4\sin(\omega t + \pi), y_4 = 2\sin(\omega t + 3\pi/2)$

are susperimposed on each other. The resulting amplitude and phase are respectively.

A. $\sqrt{45}$ and $\tan^{-1}\left(\frac{1}{2}\right)$

B. $\sqrt{45}$ and $\tan^{-1}\left(\frac{1}{3}\right)$

C. $\sqrt{75}$ and $\tan^{-1}(2)$

D. $\sqrt{75}$ and $\tan^{-1}\left(\frac{1}{3}\right)$

Answer: A

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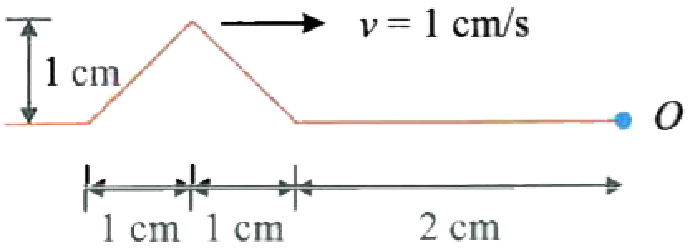
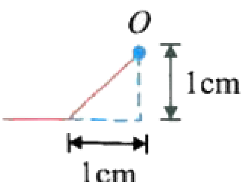
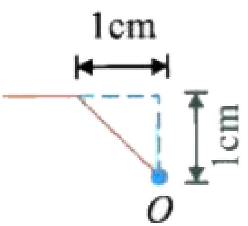
48. A wave pulse on a string has the dimension shown in figure.

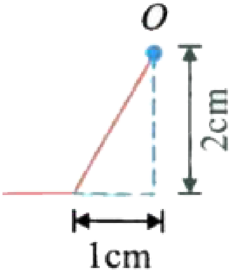


The wave speed is $v = 1cm/s$. If point O is free end. The shape of wave at time $t = 3s$ is

A. 

B. 

C. 

D. 

Answer: D

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49. The length of a sonometer wire is $90cm$ and the stationary wave setup in the wire is represented by an equation

$y = 6\sin\left(\frac{\pi x}{30}\right)\cos(250t)$ where x , y are in cm and t is in second. The number of loops is

A. 1

B. 2

C. 4

D. 3

Answer: D

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50. A sonometer is set on the floor of a lift. When the lift is at rest, the sonometer wire vibrates with fundamental frequency 256 Hz. When the lift goes up with acceleration a $= \frac{9g}{16}$, the frequency of vibration of the same wire changes to

A. $512 Hz$

B. $320 Hz$

C. $256 Hz$

D. $204 Hz$

Answer: B

Watch Video Solution

51. Standing wave produced in a metal rod of length $1m$ is represented by the equation $y = 10^{-6}\sin.\frac{\pi x}{2}\sin 200\pi t$ where x is in metre and t is in seconds. The maximum tensile stress at the mid point of the rod is (Young's modulus of material of rod $= 10^{12} N/m^2$)

A. $\frac{\pi}{2} \times 10^{6} N/m^2$

B. $2\pi \times 10^6 N/m^2$

C. $\dfrac{\pi}{2\sqrt{2}} \times 10^6 N/m^2$

D. $\dfrac{2\pi}{\sqrt{3}} \times 10^6 N/m^2$

Answer: C

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52. An addiditional bridge is kept below a sonometer wire so that it is divided into two segments of lengths in the ratio $2:3$ and n_1, n_2 are their respective fundamental frequencies. If the additional bridge is removed then the fundamental frequency of that sonometer wire is n, the ratio of n, n_1, n_2 is

A. $2:3:5$

B. $2:5:3$

C. $4:9:25$

D. $6:15:10$

Answer: D

View Text Solution

53. A piano wire $0.5m$ long and mass $5gm$ is streteched by a tension of $400N$ .The number of highest overtone that can be heared by a person is

A. 160

B. 99

C. 140

D. 120

Answer: B

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54. An iron load of 2Kg is suspended in the air from the free end of a sonometer wire of length 1m.A tuning frok of frequency 256 Hz, is in resonace with $\frac{1}{\sqrt{7}}$ times the length of the sonometer wire. If the looad is immersed in water, the length of the wire in metre that will be in resonance with the same tuning fork is (specific gravity of iron=8)

A. $\sqrt{8}$

B. $\sqrt{6}$

C. $1/\sqrt{6}$

D. $1/\sqrt{8}$

Answer: D

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55. The third overtone of a closed pipe is found to be in unison with the firest overtone of an open pipe. Find the ratio of the lengths of the pipes.

A. $6:4$

B. $7:4$

C. $4:7$

D. $4:6$

Answer: B

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56. Two closed organ pipes of length 100 cm and 101 cm 16 beats is 20 sec. When each pipe is sounded in its fundamental mode calculate the velocity of sound `

A. $303ms^{-1}$

B. $332ms^{-1}$

C. $323ms^{-1}$

D. $300ms^{-1}$

Answer: C

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57. A cylinder resonance tube open at both ends has fundamental frequency F in air. Half of the length of the tube is dipped vertically in water. The fundamental frequency to the air column now is ....

A. $f/2$

B. f

C. $3f/2$

D. $2f$

Answer: B

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58. A closed organ pipe is vibrating in first overtone and is in resonance with another open organ pipe vibrating in third harmonic. The ratio of lengths of the pipes respectively is

A. $1:2$

B. $4:1$

C. $8:3$

D. $3:8$

Answer: A

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59. A glass tube of $1.0m$ length is filled with water. The water can be drained out slowly at the bottom of the tube. If a vibrating tuning fork of frequency $500c/s$ is brought at the upper end of the tube and the velocity of sound is $300m/s$, then the total number of resonances obtained will be

A. 4

B. 3

C. 2

D. 1

Answer: B

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60. An open and a closed pipe have same length . The ratio of frequency of their nth overtone is

A. $\frac{1}{p}$

B. p

C. $\frac{2(p+1)}{2p+1}$

D. $\frac{2p+1}{2(p+1)}$

Answer: C

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61. A tube of a certain diameter and of length $48cm$ is open at both ends. Its fundamental frequency is found to be $320Hz$. The velocity of sound in air is $320 m/\sec.$ Estimate the diameter of the tube.

One end of the tube is now closed. Calculate the lowest frequency of resonance for the tube.

A. $1.33 cm$

B. $2.33 cm$

C. $3.33 cm$

D. $4.33 cm$

Answer: C

Watch Video Solution

62. A closed organ pipe has length l. The air in it is vibrating in $3rd$ overtone with a maximum amplitude of A. Find the amplitude at a distance of $l/4$ from closed end of the pipe

A. A

B. zero

C. $A/\sqrt{2}$

D. $\sqrt{3}A/2$

Answer: C

View Text Solution

63. The frequency of a streteched uniform wire of certain length is in resonance with the fundamental frequency of closed tube. If length of wire is decreased by $0.5m$, it is in resonance with first overtone of closed pipe. The initial length of wire is

A. $0.5m$

B. $0.75m$

C. $1m$

D. $1.5m$

Answer: B

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64. An open pipe resonates to a frequency f_1 and a closed pipe resonates to a frequency f_2. If they are joined together to form a longer tube, then it will resonate to a frequency of (neglect end corrections)

A. $\dfrac{f_1 f_2}{2f_2 + f_1}$

B. $\dfrac{f_1 f_2}{f_2 + 2f_1}$

C. $\dfrac{2f_1 f_2}{f_2 + f_1}$

D. $\dfrac{f_1 + 2f_2}{f_1 f_2}$

Answer: A

View Text Solution

65. The the resonance tube experiment first resonant length is l_1 and the second resonant length is l_2, then the third resonant length will be ?

A. $2l_2 - l_1$

B. $l_2 - 2l_1$

C. $l_2 - l_1$

D. $3l_2 - l_1$

Answer: A

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

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67. There are two sources of sound of equal intensity with frequencies $400Hz$ and $408Hz$ are vibrated together. The number of beats heard per second is

A. 0

B. 1

C. 8

D. 10

Answer: C

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68. If a tuning fork of frequency $512 Hz$ is sounded with a vibrating string of frequency $505.5 Hz$ the beats produced per sec will be

A. 6

B. 7

C. 6.5

D. Any of the above

Answer: C

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69. The natural frequency of a tuning fork P is 432Hz. 3 beats/s are produced when tuning fork P and another tuning fork Q are sounded together. If P is loaded with wax, the number of beats increases to 5 beats/s. The frequency of Q is

A. $429Hz$

B. $435Hz$

C. $437Hz$

D. $427Hz$

Answer: B

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70. Two organ (open) pipes of lengths $50cm$ and $51cm$ produce 6 beats/s. Then the speed of sound is nearly

A. $300m/s$

B. $306m/s$

C. $303m/s$

D. $350m/s$

Answer: B

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71. An unknown frequency x produces 8 beats per seconds with a freuquency of 250 Hz and 12 beats with $270Hz$. Source then x is

A. $258Hz$

B. $242Hz$

C. $262Hz$

D. $282Hz$

Answer: A

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72. In an experiment it was found that when a sonometer in its fundamental mode of vibration and a tunning fork gave 5 beats when length of wire is 1.05 metre or 1 metre.

The velocity of transverse waves in sonometer

wire when its length is $1m$

A. $400m/s$

B. $210m/s$

C. $420m/s$

D. $450m/s$

Answer: C

View Text Solution

73. A sonometer has 25 forks. Each produces 4 beats with the next one. If the maximum frequency is $288Hz$, which is the frequency of last fork. The lowest frequency is

A. $72Hz$

B. $96Hz$

C. $128Hz$

D. $192Hz$

Answer: D

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74. A tuning fork produces 6 beats/sec with sonometer wire when its tensions are either $169N$ or $196N$. The frequency of that fork is

A. $162Hz$

B. $190Hz$

C. $200Hz$

D. $80Hz$

Answer: A

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75. In an open pipe when air column is $20cm$ it is in resonance with tuning fork A. When length is increased by $2cm$ then the air column is tn resonance with fork B. When A and B are sounded together 4 beats/sec are heard. Frequencies of A and B are respectively (in Hz)

A. 40, 44

B. 88, 80

C. 80, 88

D. 44, 40

Answer: D

View Text Solution

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

A. 2

B. 4

C. 1

D. 8

Answer: A

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77. An air column in tun=be 32cm long, closed at one end, is in resonace with a tuning fork. The air column in another tube, open at both ends, of length 66cm is in resonance with another tuning frok.When those two tuning forks are sounded together , they produce 8 beats per second together, they produce 8 beats per second. then the frquencies of the twpo tuning forks are, (consider fundamental frequencies only)

A. $250Hz, 258Hz$

B. $240Hz, 248Hz$

C. $264Hz, 256Hz$

D. $280Hz, 272Hz$

Answer: C

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78. The string of a sonometer is divided into two parts using wedge. Total length of string is $1m$ and two parts differ by $2mm$. When sounded together they produce 2 beats/sec. The frequencies of two parts are

A. $501Hz, 503Hz$

B. $501Hz, 499Hz$

C. $499Hz, 497Hz$

D. $497Hz, 495Hz$

Answer: B

Watch Video Solution

79. On vibrating an air column at $627\,^{\circ}C$ and a tuning fork simultaneously, 6 beats/sec are heard. The frequency of fork is less than that of air column. No beats are heard at $-48\,^{\circ}C$ .The frequency of fork is

A. $3Hz$

B. $6Hz$

C. $10Hz$

D. $15Hz$

Answer: B

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

A. $27N$

B. $54N$

C. $13.5N$

D. $108N$

Answer: D

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81. Two identical piano wires have fundemental frequency of $600\ vib/\sec$, when kept under the same tension. What frectional increase in the tension of one wire will lead to the occurrence of six beats per second when both wires vibrate simuitaneously?

A. 0.01

B. 0.02

C. 0.03

D. 0.04

Answer: B

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82. The speed at which a source of sound should move so that a stationary observer finds the apparent frequency equal to $11/12$ of the original frequency

A. $V/2$

B. $2V$

C. $V/4$

D. $V/11$

Answer: D

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83. The difference between the apparent frequencies of whistle as received by an observe in rest during approach to recession of the train is 1%. If velocity of sound is 320 m/sec, the velocity of the train is

A. $5.8 km/hour$

B. $7.2 km/hour$

C. $10.3 km/hour$

D. $44.8 km/hour$

Answer: A

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84. A source of sound emitting a note of frequency 200 Hz moves towards an observer with a velocity v equal to the velocity of sound. If the observer also moves away from the source with the same velocity v, the apparent frequency heard by the observer is

A. $50 Hz$

B. $100 Hz$

C. $150 Hz$

D. $200 Hz$

Answer: D

Watch Video Solution

85. An engine giving whistle is moving towards a stationary observer with $110m/s$ speed. What will be the ratio of the frequency of the whistle heard when the engine is approaching and receding from the observer (the speed of sound is $330m/s$) ?

A. $4:3$

B. $4:1$

C. $3:6$

D. $2:1$

Answer: D

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86. Two aeroplanes 'A' and 'B' are moving away from one another with a speed of $720 kmph$. The frequency of the whistle emitted by 'A' is $1100 Hz$. The apparent frequency of the whistle as heard by the passenger of the aeroplane 'B'

is (velocity of sound in air is $350 ms^{-1}$).

A. $300 Hz$

B. $400 Hz$

C. $500 Hz$

D. $600 Hz$

Answer: A

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87. An engine is moving on a circular path of radius 100 m with a speed of 20 m/s. What will be frequency noted by an observer standing stationary at the centre of the circular path when the engine blows a whistle of frequency 500 Hz ?

A. more than $500 Hz$

B. less than $500 Hz$

C. $500 Hz$

D. no sound is heard

Answer: C

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88. The frequency of a radar is 780 MHz. After getting reflected from an approaching aeroplane, the apparent frequency is more than the actual frequency by 2.6 kHz. The aeroplane has a speed of

A. $2Km/se$

B. $1Km/se$

C. $0.5Km/s$

D. $0.25Km/s$

Answer: C

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89. An observer moves towards a stationary source of sound, with a velocity one-fifth of the velocity of sound. What is the percentage increase in the apparent frequency?

A. 5%

B. 20%

C. zero

D. 0.5%

Answer: B

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90. A train is moving at $30m/s$ in still air. The frequency of the locomotive whistle is $500Hz$ and the speed of sound is $345m/s$. The apparent wavelengths of sound in front of and behind the locomotive are respectively

A. $0.63m, 0.80m$

B. $0.63m, 0.75m$

C. $0.60m, 0.85m$

D. $0.60m, 0.75m$

Answer: B

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91. A vehicle, with a horn of frequency n is moving with a velocity of 30 m/s in a direction perpendicular to the straight line joining the observer and the vehicle. The observer perceives the sound to have a frequency $n + n_1$. Then (if the sound velocity in air is 300 m/s)

A. $n_1 = 10n$

B. $n_1 = 0$

C. $n_1 = 0.1n$

D. $n_1 = -0.1n$

Answer: B

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92. A source of sound is travelling towards a stationary observer. The frequency of sound heard by the observer is 25% more than the actual frequency. If the speed of sound is v, that of the source is

A. $V/5$

B. $V/4$

C. $V/3$

D. $V/2$

Answer: A

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93. A truck blowing horn of frequency $500Hz$ travels towards a vertical mountain and driver hears echo of frequency $600Hz$. If velocity of sound in air is $340m/s$ then speed of truck is

A. $31 m / s$

B. $41 m / s$

C. $51 m / s$

D. $21 m / s$

Answer: A

View Text Solution

94. One train is approaching an observer at rest and another train is receding from him with the same velocity $4 m / s$. Both trains blow whistles of same frequency of $243 H_Z$. The beat frequency in H_Z as heard by observer is (speed of sound in air = $320 m / s$)

A. 10

B. 6

C. 4

D. 1

Answer: B

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95. A tuning fork of frequency $328 Hz$ is moved towards a wall at a speed of $2 ms^{-1}$. An observer standing on the same side as the fork hears two sounds, one directly from the fork and the other reflected from the wall. Number of beats per second is (Velocity of sound in air $330 ms^{-1}$).

A. 4

B. 5

C. 6

D. 7

Answer: A

Watch Video Solution

96. The frequency of the sound of a car horn as recorded by an observer towards whom the car is moving differs from the frequency of the horn by 10%. Assuming the velocity of sound in air to be $330ms^{-1}$, the velocity of the car is

A. $36.7ms^{-1}$

B. $40ms^{-1}$

C. $30ms^{-1}$

D. $33ms^{-1}$

Answer: C

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97. Two trains are approaching each other on parallel tracks with same velocity. The whistle sound produced by one train is heard by a passenger in another train. If actual frequency of whistle is $620Hz$ and apparent increase in its frequency is $100Hz$, the velocity of one of the two trains is (Velocity of sound in air $= 335ms^{-1}$)

A. $90kmph$

B. $72kmph$

C. $54kmph$

D. $36kmph$

Answer: A

View Text Solution

98. A girl swings in a cardle with period $\pi/4$ second and amplitude $2m$. A boy standing infront of it blows a whistle of natural frequency $1000Hz$. The minimum frequency as heard by the girl is (Velocity of sound in air is $320ms^{-1}$)

A. $850Hz$

B. $1000Hz$

C. $750Hz$

D. $950Hz$

Answer: D

View Text Solution

99. The difference between the apparent frequency of a source of sound as perceived by an observer during its approach and recession is 2% of the natural frequency of the source. Then the speed of the source will be

A. $12m/s$

B. $6.2m/s$

C. $3.4m/s$

D. $1.5m/s$

Answer: C

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100. Two different sound sources S_1 and S_2 have frequencies in the ratio $1:2$. Source S_1 is approaching towards observer and S_2 receding from same observer. Speeds of both S_1 and S_2 are V each and speed of sound air is

$330 m/s$. If no beats are heard by the observer then the value of V is

A. $50 m/s$

B. $75 m/s$

C. $110 m/s$

D. $125 m/s$

Answer: C

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101. A stationary source emitting sound of frequency $680Hz$ is at the origin . An observer is moving with the velocity $\sqrt{2}\left(\hat{i}+\hat{j}\right)m/s$ at a certain instant. If the speed of sound in air is $340m/s$ then the apparent frequency received by him at that instant is

A. $680Hz$

B. $676Hz$

C. $684Hz$

D. either $676Hz$ or $684Hz$

Answer: D

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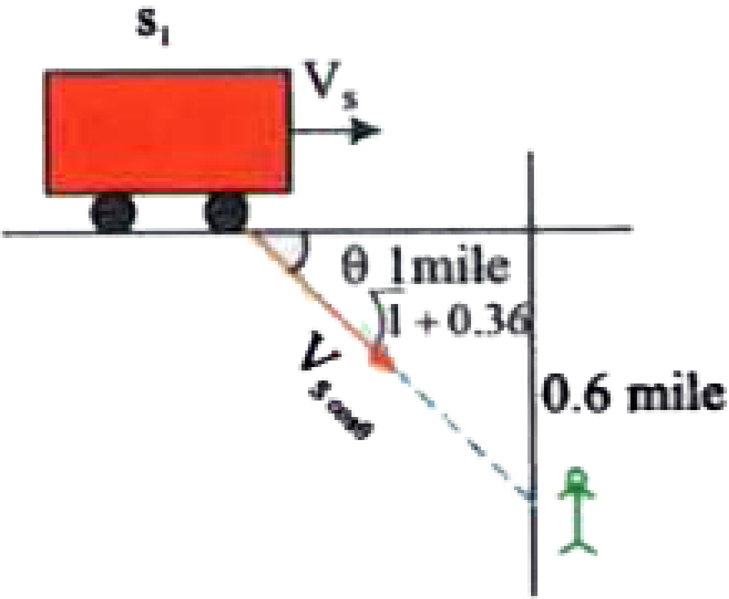
102. A source S emitting sound of frequency $300 Hz$ is fixed on block A which is attached to the free end of a spring S_A as shown in figure. The detector D fixed on block B attached to free end of spring S_B detects this sound. The blocks A and B are simultaneously displaced towards each other through a distance of $1.0 m$ and then left to vibrate. The maximum and minimum frequencies of sound detected by D, if the vibrational frequency of each block is $2Hz$ are (Velocity of sound $v = 340m/s$)



A. $378.6Hz$, $223Hz$

B. $323Hz$, $278.6Hz$

C. $178Hz$, $276Hz$

D. $420Hz, 220Hz$

Answer: B

Watch Video Solution

103. An observer is standing 500 m away from a vertical hill. Starting between the observer and the hill, a police van sounding a siren of frequency 1000 Hz moves towards the hill with a uniform speed. If the frequency of the sound heard directly from the siren is 970 Hz, the frequency of the sound heard after reflection from the hill (in Hz) is about,(velocity of sound $= 330ms^{-1}$

A. 1042

B. 1032

C. 1022

D. 1012

Answer: B

Watch Video Solution

104. A star is moving away from the earth with a velocity of 10^5 m/sec. If wavelength of its spectral line be 5700Å, the Doppler's shift will be

A. 1.9Å towards violet end

B. 1.9Å towards red end

C. 3.8Å towards violet end

D. 3.8Å towards red end

Answer: B

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Exercise-I (H.W)

1. Which of the following represents a progressive wave

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

B. $y = \dfrac{8}{3 + (x - vt)^2}$

C. $y = \sqrt{yt - x}$

D. all the above

Answer: D

Watch Video Solution

2. A longitudinal progressive wave is given by the equation $y = 5x10^{-2}\sin\pi(400t + x)$. The amplitude and wave length of the wave are (y,x are in m)

A. $A = 5x10^{-2}m, \lambda = 2m$

B. $A = 5x10^{-2}m, \lambda = 3m$

C. $A = 5x10^{-2}m, \lambda = 4m$

D. $A = 5x10^{-2}m, \lambda = 5m$

Answer: A

View Text Solution

3. The equation of a progressive wave is $y = 0.05\sin\left(200t - \frac{x}{2}\right)$ where x,y are in metres and t in seconds then

(a) velocity of wave is $100ms^{-1}$

(b) max velocity of particle is $10ms^{-1}$

(c) wavelength of wave is $4m$

A. only a and c are true

B. only b and c are true

C. only a and b are true

D. a,b,c are true

Answer: B

View Text Solution

4. The equation of a transverse wave is $y = a\sin 2\pi[t - (x/5)]$, then the ratio of maximum particle velocity and wave velocity is

A. $\frac{2\pi a}{\sqrt{5}}$

B. $\frac{2\pi a}{5}$

C. $\frac{a}{5}$

D. $2\pi a\sqrt{5}$

Answer: B

Watch Video Solution

5. The frequency of a tuning fork is $256Hz$. The velocity of sound in air is $344ms^{-1}$.The distance travelled (in metres) by the sound during the time in which the tuning fork completes 32vibrations

A. 21

B. 43

C. 86

D. 129

Answer: B

Watch Video Solution

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

A. 40°

B. $20rad$

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

D. $\left(\frac{\pi}{9}\right)^{\circ}$

Answer: C

Watch Video Solution

Watch Video Solution

7. The equation of a wave is $y = 4\sin\left\{\frac{\pi}{2}\left(2t + \frac{x}{8}\right)\right\}$ where y, x are in cm and time in seconds . The acceleration of particle located at $x = 8cm$ and $t = 1\sec$ is

A. $4\pi^2 cm/s^2$

B. $-4\pi^2 cm/s^2$

C. $16\pi^2 cm/s^2$

D. $-16\pi^2 cm/s^2$

Answer: A

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8. A standing wave set up in a medium is $y = 4\cos\left(\frac{\pi x}{3}\right)\sin 40\pi t$ where x,y are in cm and t in sec The velocity of medium perticle at $x = 6cm$ at $t = 1/8$sec is

A. $40\pi cm/s$

B. $80\pi cm/s$

C. $120\pi cm/s$

D. $-160\pi cm/s$

Answer: D

View Text Solution

9. 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?

A. 2 units, -2 units

B. 2 units, 2 units

C. 10 units, 5 units

D. 10 units, 10 units

Answer: A

Watch Video Solution

10. A wave of angular frequency 30 rad//sec propagates so that a certain phase of oscillationn moves along x-axis, y-axis , z-axis with speeds $1m/s$, $2m/s$ and $2m/s$ respectively. The propagation constant K is

A. $30\hat{i} + 15\hat{j} + 15\hat{k}$

B. $10\hat{i} + 10\hat{j} + 10\hat{k}$

C. $30\hat{i} + 30\hat{j} + 30\hat{k}$

D. $6\hat{i} + 6\hat{j} + 6\hat{k}$

Answer: A

Watch Video Solution

11. The situation of a wave pulse is given as $y = \frac{0.8}{(4x + 5t) + 4}$ the amplitude and velocity of pulse are

A. 0.2 units, 1.25 units along - ve x-axis

B. 0.2 units, 1.25 units along $+$ ve x-axis

C. 0.4 units, 1.25 units along - ve x-axis

D. 0.4 units, 1.25 units along $+$ ve x-axis

Answer: A

View Text Solution

12. A suspension bridge is to be built across valley where it is known that the wind can gust at 5s intervals .It is estimated that the speed of transverse waves along the span of the bridge would be 400 m/s . The danger of resonant motions in the bridge at its fundamental frequency would be greater if the span had a length of

A. $2000m$

B. $1000m$

C. $400m$

D. $80m$

Answer: A

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13. A uniform rope of length 20m and mass 5kg is hanging vertically from a rigid support. A block of mass 4kg is attached to the free end.

The wave length of the transverse wave pulse at the lower end of the rope is 0.04 m. The wavelength of the same pulse as it reaches the top is

A. $0.06m$

B. $0.12m$

C. $1.5m$

D. $2.2m$

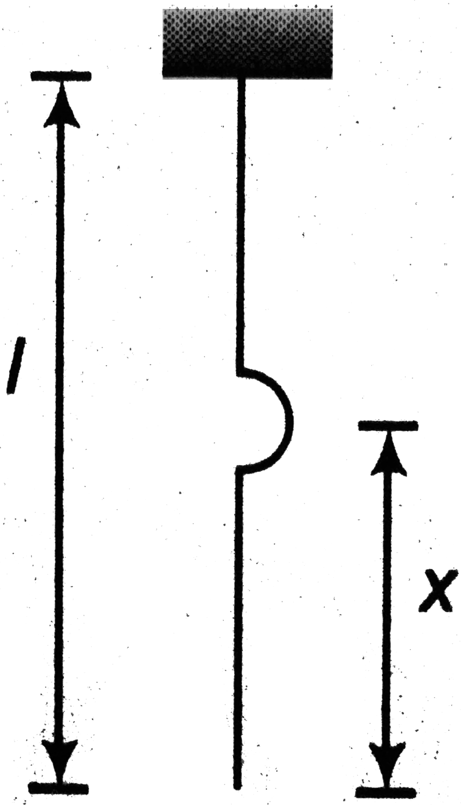
Answer: A

Watch Video Solution

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

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

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



A. $0.7 m/s, 1 s$

B. $0.7 m/s, 2 s$

C. $0.7 m/s, 4 s$

D. $0.7m/s, 6s$

Answer: A

Watch Video Solution

15. A rope of length L and mass m hangs freely from the ceiling. The velocity of transverse wave as a function of position x from the bottom is proportional to

A. x°

B. $\sqrt{x}$

C. $\frac{1}{\sqrt{x}}$

D. x

Answer: B

Watch Video Solution

16. A string of length 10.0 m and mass 1.25kg stretched with a tension of 50N. If a transverse pulse is created at one end of the string, how long does it take to reach the other end ?

A. $0.5s$

B. $1.0s$

C. $1.5s$

D. $2.0s$

Answer: B

Watch Video Solution

17. The linear density of a vibrating string is $1.3 \times 10^{-4} kg/m$ A transverse wave is propagating on the string and is described by the equation $y = 0.021\sin(x + 30t)$ where x and y are measured in meter and tt in second the tension in the string is :-

A. $0.12N$

B. $0.48N$

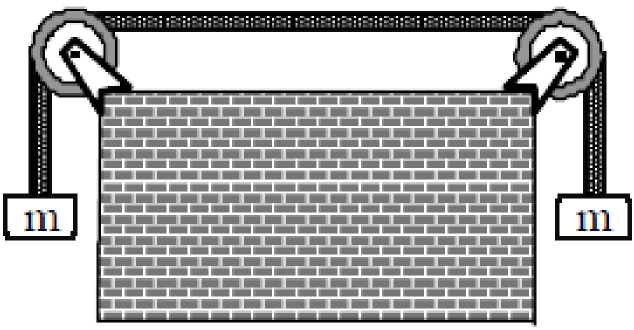
C. $1.2N$

D. $4.8N$

Answer: A

Watch Video Solution

18. In the given arrangement, if hanging mass will be changed by 4%, then percentage change in the wave speed in string will be:



A. 2 %

B. 8 %

C. 3 %

D. 4 %

Answer: A

Watch Video Solution

19. The extension in a string, obeying Hooke's law is x. The speed of sound in the stretched string is V. If the extension in the string is increased to $2x$ then speed of sound will be

A. $1.5V$

B. $4.14V$

C. $1.414V$

D. $2V$

Answer: C

Watch Video Solution

20. The speed of transverse waves in a stretched string is $700 cm/s$. If the string is $2m$ long, the frequency with which it resonates in fundamental mode is

A. $(7/12)Hz$

B. $(7/4)Hz$

C. $14Hz$

D. $(2/7)Hz$

Answer: B

Watch Video Solution

21. Two waves represented by $y = a \quad \sin(\omega t - kx)$ and $y = a \quad \sin\left(\omega t - kx + \frac{2\pi}{3}\right)$

are superposed. What will be the amplitude of the resultant wave?

A. $2a$

B. $3a$

C. $4a$

D. a

Answer: D

Watch Video Solution

22. The minimum phase difference between the two simple harmonic oscillations

$x_1 = (1/2)\sin\omega t + \left(\sqrt{3}/2\right)\cos\omega t$ and

$x_2 = \left(\sqrt{3}/2\right)\sin\omega t + (1/2)\cos\omega t$ is

A. 30°

B. 60°

C. 45°

D. 0°

Answer: A

Watch Video Solution

23. Two waves of amplitudes A_0 & xA_0 pass through a region. If $x > 1$, the difference in the maximum and minimum resultant amplitude possible it

A. $(x + 1)A_0$

B. $(x - 1)A_0$

C. $2xA_0$

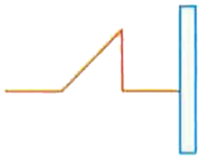
D. $2A_0$

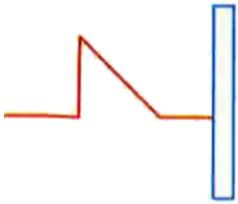
Answer: D

Watch Video Solution

24. A pulse in a rope approaches a solid wall and it gets reflected from it

The wave pulse after reflection is best represented by

A. 

B. 

C. 

D. 

Answer: C

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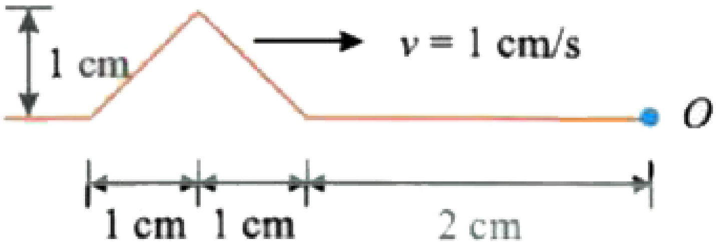
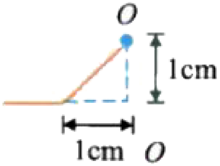
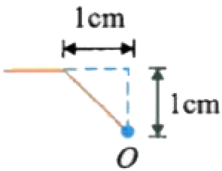
25. A wave pulse on a string has the dimension at time $t = 0$ as shown below is reflected from a fixed end O.

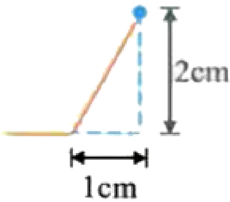


Its dimensions at $t = 3s$ is

A. 

B. 

C. 

D. 

Answer: A

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26. The length of a sonometer wire is $90cm$ and the stationary wave setup in the wire is represented by an equation $y = 6\sin\left(\frac{\pi x}{30}\right)\cos(250t)$ where x , y are in cm and t is in second. The distances of successive antinodes from one end of the wire are

A. $22.5cm, 67.5cm$

B. $15cm, 30cm, 60cm$

C. $15cm, 45cm, 75cm$

D. $30cm, 45cm, 60cm$

Answer: C

Watch Video Solution

27. A sonometer consists of two wire of length , same material whose radii are in the ratio $2:3$. The ratio of tension in two wire if their fundamental freqencies are equal is

A. $1:4$

B. $2:3$

C. $9:4$

D. $4:9$

Answer: D

Watch Video Solution

28. The bridge of a sonometer is slightly displaced so that the length of wire is decreased by 0.5% and tension in the wire is increased by 1%. The fundamental frequency of wire

A. increases by 1%

B. decreases by 1%

C. increases by 1.5%

D. decreases by 1.5%

Answer: A

View Text Solution

29. A segment of wire vibrates with a fundamental frequency of 450 Hz under a tension of 9Kg-wt.Then, tension at which the fundamental frequency of the same wire becomes 900 Hz is

A. $36 kgwt$

B. $27 kgwt$

C. $18 kgwt$

D. $72 kgwt$

Answer: A

Watch Video Solution

30. In Melde's experiment, the string vibrates in 4 loops when a 50 gram weight is placed in the pan of weight 15 gram . To make the string to vibrates in 6 loops the weight that has to be removed from the pan is

A. $72 gm$

B. $36 gm$

C. $21 gm$

D. $29 gm$

Answer: B

Watch Video Solution

31. Two vibrating strings of the same material but lengths L and $2L$ have radii $2r$ and r respectively. They are stretched under the same tension. Both the string vibrate in their fundamental nodes, the one of length L with freuqency v_1 and the other with frequency v_2. the ratio v_1/v_2 is given by

A. 2

B. 4

C. 8

D. 1

Answer: D

Watch Video Solution

32. v20

A. $140m/s$

B. $360m/s$

C. $340m/s$

D. $280m/s$

Answer: D

Watch Video Solution

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

A. $2:3$

B. $1:2$

C. $1:3$

D. $1:4$

Answer: C

Watch Video Solution

34. A string of length l along x-axis is fixed at both ends and is vibrating in second harmonic. If at $t = 0$, $y = 2.5mm$ for incident wave, the equation of standing wave is (T is tension and μ is linear density)

A. $(2.5mm)\sin\left(\frac{2\pi}{l}x\right)\cos\left(2\pi\sqrt{\left(\frac{T}{\mu l^2}\right)}t\right)$

B. $(5mm)\sin\left(\frac{\pi}{l}x\right)\cos 2\pi t$

C. $(5mm)\sin\left(\frac{2\pi}{l}x\right)\cos\left(2\pi\sqrt{\left(\frac{T}{\mu l^2}\right)}t\right)$

D. $(5mm)\cos\left(\frac{2\pi}{l}x\right)\cos\left(2\pi\sqrt{\left(\frac{T}{\mu l^2}\right)}t\right)$

Answer: C

Watch Video Solution

35. A steel wire of length $1m$, mass $0.1kg$ and uniform cross-sectional area $10^{-6}m^2$ is rigidly fixed at both ends. The temperature of the wire is lowered by $20\,^\circ C$. If transverse waves are set up by plucking the string in the middle.Calculate the frequency of the fundamental mode of vibration.

Given for steel $Y = 2 \times 10^{11}N/m^2$

$\alpha = 1.21 \times 10^{-5} per\,^\circ C$

A. $21Hz$

B. $42Hz$

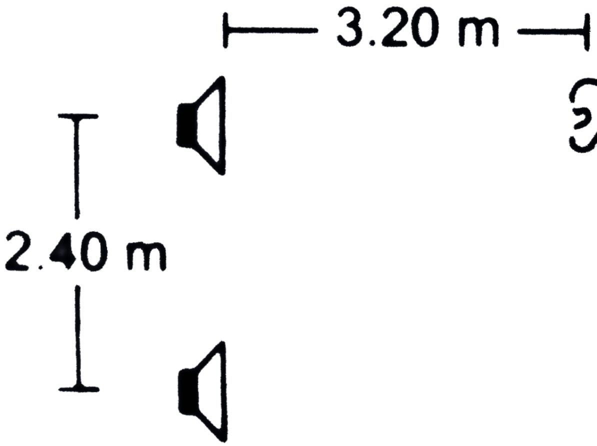
C. $11Hz$

D. $22Hz$

Answer: C

Watch Video Solution

36. Two stereo speakers are separated by a distance of 2.40 m. A person stands at a distance of 3.20 m directly in front of one of the speakers as shown in figure. Find the frequencies in the audible range (20-2000 Hz) for which the listener will hear a minimum sound intensity. Speed of sound in air $= 320ms^{-1}$



A. $160(2n + 1)$

B. $320(2n + 1)$

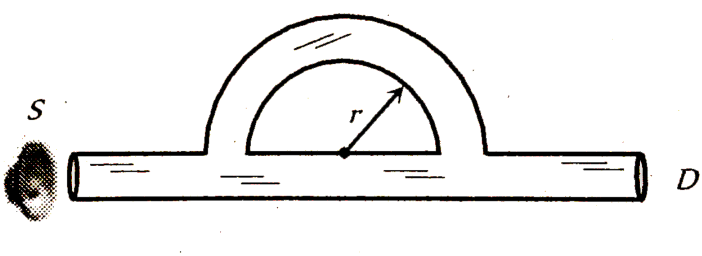
C. $200(2n + 1)$

D. $100(2n + 1)$

Answer: C

Watch Video Solution

37. A sound wave of wavelength 32 cm enters the tube at S as shown in the figure. Then the smallest radius r so that a minimum of sound is heard at detector D is



A. $7cm$

B. $14cm$

C. $21cm$

D. $28cm$

Answer: D

Watch Video Solution

38. A sonometer wire with a suspended mass of M=1 kg is in resononce with a given tuning fork. The apparatus is taken to the moon where the acceleration due to gravity is $1/6^{th}$ that on earth. To obtain resonance on the moon, the value of M should be

A. $1kg$

B. $\sqrt{6}kg$

C. $6kg$

D. $36kg$

Answer: C

Watch Video Solution

39. A sonometer wire of length L is plucked at a distance $L/8$ from one end then it vibrates with a minimum frequency n. If the same wire is plucked at a distance $L/6$ from another end the minimum frequency with which it vibrates is

A. $\frac{\sqrt{3}}{2} n$

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

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

D. $\frac{4n}{3}$

Answer: C

Watch Video Solution

40. A metal wire of linear mass density of $9.8 g/m$ is stretched with a tension of $10 kg$ - wt between two rigid support $1 meter$ apart. The wire passes at its middle point between the poles of a permanent magnet, and it vibrates in resonance when carrying an alternating current of frequency n. the frequency n of the alternating source is

A. $50Hz$

B. $100Hz$

C. $200Hz$

D. $25Hz$

Answer: A

Watch Video Solution

41. A stretched wire of length $114cm$ is divided into three segments whose frequencies are in the ratio $1:3:4$, the lengths of the segments must be in the ratio :

A. $18:24:72$

B. $24:72:18$

C. $24:18:72$

D. $72:24:18$

Answer: D

Watch Video Solution

42. If $n_1, n_2 \text{and} n_3$ are the fundamental frequencies of three segments into which a string is divided, then the original fundamental frequency n of the string is given by

A. $\frac{1}{n} = \frac{1}{n_1} + \frac{1}{n_2} + \frac{1}{n_3}$

B. $\frac{1}{\sqrt{n}} = \frac{1}{\sqrt{n_1}} + \frac{1}{\sqrt{n_2}} + \frac{1}{\sqrt{n_3}}$

C. $\sqrt{n} = \sqrt{n_1} + \sqrt{n_2} + \sqrt{n_3}$

D. $n = n_1 + n_2 + n_3$

Answer: A

Watch Video Solution

43. If at STP, velocity of sound in a gas $(y = 1.5)$ is $600m/s$, the rms velocity of the gas molecules at STP will be

A. $400m/s$

B. $600m/s$

C. $600\sqrt{2}m/s$

D. $300\sqrt{2}m/s$

Answer: C

View Text Solution

44. If the speed of sound is changed by 1 per cent, how much must the temperature of air neae $0^{\circ} C$ be changed

A. $5^{\circ} C$

B. $6^{\circ} C$

C. $5.5^{\circ} C$

D. $6.5^{\circ} C$

Answer: C

Watch Video Solution

45. Calculate the ration of speed of sound in neon to that in water vapours at any temperature. Molecular weight on neon $= 2.02 \times 10^{-2} kg / mole$ and for water vapours, molecular weight is $1.8 \times 10^{-2} kg / mole$.

A. $9/8$

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

C. $3/2$

D. $3/4$

Answer: B

Watch Video Solution

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

A. $460ms^{-1}$

B. $500ms^{-1}$

C. $650ms^{-1}$

D. $1420ms^{-1}$

Answer: D

Watch Video Solution

47. If the young's modulus of the material of the rod is $2 \times 10^{11} N/m^2$ and its density is $8000 kg/m^3$ then the time taken by a sound wave to traverse 1m of the rod will be

A. $1.11 \times 10^{-4} s$

B. $3 \times 10^{-4} s$

C. $2 \times 10^{-4} s$

D. $1 \times 10^{-4} s$

Answer: C

Watch Video Solution

48. v34

A. $\sqrt{\frac{P}{Q}}$

B. $\sqrt{PQ}$

C. $\frac{P}{Q}$

D. PQ

Answer: A

Watch Video Solution

49. Velocity of hydrogen at NTP is V. The velocity of sound in a mixture of hydrogen and oxygen in the ratio of $4:1$ at NTP is

A. $\frac{1}{5}V$

B. $\frac{1}{4}V$

C. $\frac{1}{3}V$

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

Answer: D

Watch Video Solution

50. Calculate the velocity of sound in a mixture of two gases obtained by mixing V_1 and V_2 volumes of them if the velocity of sound in them be C_1 and C_2. The atomicity of the gases

is the same.

A. $C_1C_2\sqrt{\dfrac{V_1 + V_2}{V_1c_2^2 + V_2c_1^2}}$

B. $C_1C_2\sqrt{\dfrac{V_1 + V_2}{V_1c_1^2 + V_2c_2^2}}$

C. $C_1C_2\sqrt{\dfrac{V_1 + V_2}{V_1^2c_1 + V_2c_2^2}}$

D. $C_1C_2\sqrt{\dfrac{V_1 + V_2}{V_1^2c_1 + V_2^2c_2}}$

Answer: A

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51. The air column in a pipe which is closed at one end will be in resonance with a vibrating tuning fork at a frequency $260Hz$, if the length of the air column is (speed of sound in air $= 330ms^{-1}$)

A. 31.73cm

B. 62.5cm

C. 35.75cm

D. 12.5cm

Answer: A

View Text Solution

52. A cylindrical tube, open at the both ends, has a fundamental frequency f in air . The tube is dipped vertically in water so that half of it is in water . The fundamental frequency of the air column is now-

A. $3n$

B. $2n/3$

C. $n/3$

D. n

Answer: B

Watch Video Solution

53. An open pipe and a closed pipe are in resonance with each other with their first overtones. The ratio of their lengths are

A. $4:3$

B. $3:4$

C. $1:3$

D. $3:1$

Answer: A

Watch Video Solution

54. A pipe of length $85cm$ is closed from one end. Find the number of possible natural oscillations of air column in the pipe whose frequencies lie below $1250 Hz$. The velocity of sound in air is $34 m/s$.

A. 12

B. 8

C. 6

D. 4

Answer: C

Watch Video Solution

55. A tuning fork of frequency 340Hz vibrated above a cylindrical hallow tube closed at one end. The height of the tube is 120cm . Water is slowly poured in it. What is the minimum height of water required for resonance ?

A. $25cm$

B. $45cm$

C. $75cm$

D. $95cm$

Answer: B

Watch Video Solution

56. An organ pipe P_1, closed at one end and containing a gas of density ρ_1 is vibrating in its first harmonic. Another organ pipe P_2, open at both ends and containing a gas of density ρ_2, is vibrating in its third harmonic. Both the pipes are in resonance with a given tuning fork. If the compressibility of gases is equal in both pipes, the ratio of the lengths of P_1 and P_2 is (assume the given gases to be monoatomic)

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

B. 3

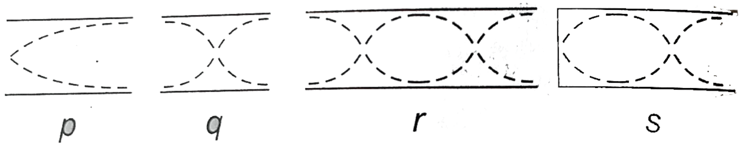
C. $\frac{1}{6}\sqrt{\frac{\rho_1}{\rho_2}}$

D. $\frac{1}{6}\sqrt{\frac{\rho_2}{\rho_1}}$

Answer: D

Watch Video Solution

57. The vibrations of four air columns are represented in the adjoining figures. The ratio of frequencies $n_p : n_q : n_r : n_s$ is



A. $12:6:3:5$

B. $1:2:4:3$

C. $4:2:3:1$

D. $6:2:3:4$

Answer: B

Watch Video Solution

58. An open pipe of length $24cm$ is in resonance with a frequency $660Hz$ in fundamental mode. The radius of pipe is $\left(V = 330ms^{-1}\right)$

A. $3cm$

B. $0.83cm$

C. $3.5cm$

D. $2cm$

Answer: B

Watch Video Solution

59. An open organ pipe has length l .The air in it vibrating in 3^{rd} overtone with maximum amplitude A . The amplitude at a distance of $\frac{l}{16}$ from any open end is.

A. A

B. Zero

C. $\frac{A}{\sqrt{2}}$

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

Answer: C

Watch Video Solution

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

A. $16N$

B. $8N$

C. $4N$

D. $1N$

Answer: D

Watch Video Solution

61. An open pipe resonates with frequency $100Hz$ and a closed pipe resonates with frequency $50Hz$. If they are joined to form a longer tube then it will resonate with frequency of (neglect end corrections)

A. $25Hz$

B. $50Hz$

C. $75Hz$

D. $100Hz$

Answer: A

View Text Solution

62. In a resonance column, first and second resonance are obtained at depths 22.7 cm and 70.2 cm. The third resonance will be obtained at a depth

A. $117.7cm$

B. $92.9cm$

C. $115.5cm$

D. $113.5cm$

Answer: A

Watch Video Solution

63. A 'pop' gun consists of a tube 25 cm long closed at one end by a cork and at the other end by a tightly fitted piston. The piston is pushed slowly in. When the pressure rises to one and half times the atmospheric pressure, the cork is violently blown out. Calculate the frequency of the 'pop' caused by its ejection. Speed ofsound in air is 340 m/s

A. $510Hz$

B. $1020Hz$

C. $205Hz$

D. $740Hz$

Answer: A

Watch Video Solution

64. When tuning forks A and B are sounded together 5 beats per second are heard. Frequency of A is $250Hz$. On loading A with wax 2 beats per second are produced with B. The frequency of B is

A. $255Hz$

B. $320Hz$

C. $245Hz$

D. $420Hz$

Answer: C

Watch Video Solution

65. Two open pipes of length $20cm$ and $20.1cm$ produces 10 beats/s. The velocity of sound in the gas is

A. $804ms^{-1}$

B. $402ms^{-1}$

C. $420ms^{-1}$

D. $330ms^{-1}$

Answer: A

Watch Video Solution

66. Two tuning forks have frequencies $200Hz$ and x. When they are sounded together 4 beats/sec are heard. The value of x is

A. $200Hz$ or $198Hz$

B. $196Hx$ or $204Hz$

C. $205Hz$ or $201Hz$

D. $200Hz$ only

Answer: B

View Text Solution

67. A tuning fork of frequency 480 Hz produces 10 beats per second when sounded with a vibrating sonometer string. What must have been the frequency of the string if a slight increase in tension produces lesser beats per second than before

A. $460Hz$

B. $480Hz$

C. $490Hz$

D. $470Hz$

Answer: D

Watch Video Solution

68. Five beats per second are produced on vibrating two closed organ pipes simultaneously. If the ratio of their lengths is $21:20$, then their frequencies will be

A. $105Hz$ and $100Hz$

B. $105Hz$ and $110Hz$

C. $100Hz$ and $105Hz$

D. $110Hz$ and $105Hz$

Answer: C

Watch Video Solution

69. An accurate and reliable audio oscillator is used to standardize a tuning fork. When the oscillator reading is $514Hz$, two beats are hear per second. When the oscillator reading is $510 Hz$, the beat frequency is $6 Hz$. The frequency of the tuning fork is

A. 506

B. 510

C. 516

D. 158

Answer: C

Watch Video Solution

70. 25 tuning forks are arranged in series in the order of decreasing frequency. Any two successive forks produce 3 beats/sec. If the frequency of the first turning fork is the octave of the last fork, then the frequency of the 21st fork is

A. $72Hz$

B. $288Hz$

C. $84Hz$

D. $87Hz$

Answer: C

Watch Video Solution

71. A tuning fork produces 4 beats/s with a sonometer wire when its lengths are $50cm$, $51cm$. The frequency of that tuning fork is

A. $400Hz$

B. $404Hz$

C. $408Hz$

D. $412Hz$

Answer: B

Watch Video Solution

72. In a closed tube when air column is $20cm$ it is in resonance with tuning fork A. When the length is increased by $2cm$ then the air column is in resonance with tuning fork B. When A and B are sounded together they produce 8 beats per second . The frequencies of the tuning forks A and B are (in Hz)

A. 40, 44

B. 88, 30

C. 80, 88

D. 44, 40

Answer: B

Watch Video Solution

73. A closed organ pipe and an open organ pipe of some length produce $2 beats$ when they are set up into vibration simultaneously in their fundamental mode . The length of the open organ pipe is now halved and of the closed organ pipe is doubled , the number of beats produced will be

A. 8

B. 4

C. 7

D. 2

Answer: C

Watch Video Solution

74. A closed pipe is suddenly opened and changed to an open pipe of same length . The fundamental frequency of the resulting open pipe is less than that of $3rd$ hoarmonic of the earlier closed pipe by $55Hz$. Then , the value of fundamental frequency of the closed pipe is

A. $165Hz$

B. $100Hz$

C. $55Hz$

D. $220Hz$

Answer: C

View Text Solution

75. A fork gives 5 beats with a 40cm length of sonometer wire. If the length of the wire is shortened by 1cm, the number of beats is still the same. The frequency of the fork is

A. $385Hz$

B. $320Hz$

C. $395Hz$

D. $400Hz$

Answer: C

Watch Video Solution

76. Two tuning forks A and B are sounded together and $8 beats/s$ are heard . A is in resonance with a column of air $32 cm$ long in a pipe closed at one end and B is increased by one cm. Calculate the frequency of fork .

A. $264Hz, 256Hz$

B. $272Hz, 264Hz$

C. $231Hz, 224Hz$

D. $220Hz, 512Hz$

Answer: C

Watch Video Solution

77. An organ pipe, open from both end produces 5 beats per second when vibrated with a source of frequency 200 Hz . The second harmonic of the same pipes produces 10 beats per second with a source of frequency 420 Hz .

The frequency of source is

A. $195 Hz$

B. $205 Hz$

C. $190 Hz$

D. $210 Hz$

Answer: B

Watch Video Solution

78. When a vibrating tuning fork is placed on a sound box of a sonometer, 8 beats per second are heard when the length of the sonometer wire is kept at 101cm or 100cm. Then the frequency of the tuning frok is (consider that the tension in the wire is kept constant)

A. $1616 Hz$

B. $1608 Hz$

C. $1632 Hz$

D. $1600 Hz$

Answer: B

Watch Video Solution

79. The two parts of a sonometer wire divided by a movable knife edge , differ in length by $2mm$ and produce $1beat/s$, when sounded together . Find their frequencies if the whole length of wire is $1.00m$.

A. 250.5 and 249.5

B. 230.5 and 229.5

C. 220.5 and 219.5

D. 210.5 and 209.5

Answer: A

Watch Video Solution

80. When an air column at $27^{\circ} C$ and a tuning fork are sounded together, 5 beats per second are produced. The frequency of the fork is less than that of air column. No beat is heard at $-3^{\circ} C$. Determine the frequency of the fork.

A. $70Hz$

B. $147Hz$

C. $104Hz$

D. $90Hz$

Answer: D

Watch Video Solution

81. The wavelength of two sound notes in air are $\frac{40}{195}m$ and $\frac{40}{193}m$. Each note produces 9 beats per second, separately with a third note of fixed frequency. The velocity of sound in air in m//s is

A. 360

B. 320

C. 300

D. 340

Answer: A

View Text Solution

82. A train in approaching a station with a uniform velocity of $72 kmph$ and the frequency of the whistle of that train is $480 Hz$. The apparent increase in the frequency of that whistle heard by a stationary observer on the platform is (Velocity of sound in air is $340 m/s$)

A. $60 Hz$

B. $45 Hz$

C. $30 Hz$

D. $15 Hz$

Answer: C

Watch Video Solution

83. A train is travelling at $120 kmph$ and blows a whistle of frequency $1000 Hz$. The frequency of the note heard by a stationary observer if the train is approaching him and moving away from him are (Velocity of sound in air $= 330 = ms^{-1}$)

A. $1112 Hz, 908 Hz$

B. $908Hz, 1112Hz$

C. $1080Hz, 820Hz$

D. $820Hz, 1080Hz$

Answer: A

Watch Video Solution

84. A source and an observer move away from each other with a velocity of 10 m/s with respect to ground. If the observer finds the frequency of sound coming from the source as

1950 Hz , then actual frequency of the source is (velocity of sound in air = 340 m/s)

A. $2068Hz$

B. $1832Hz$

C. $1950Hz$

D. $1650Hz$

Answer: A

Watch Video Solution

85. An observer is moving on a circular path of radius r with speed V_0 around source kept at centre. The apparent frequency observed by observer is (n is actual frequency)

A. greater than n

B. less than n

C. n

D. no sound is heard

Answer: C

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Watch Video Solution

86. A source of sound moves towards a listener with a velocity equal to that of sound. If the source emits n waves per second, then the listener moving away from the source with the same velocity receives

A. n waves per sec

B. 2n waves per sec

C. zero waves per sec

D. $n/2$

Answer: C

Watch Video Solution

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

A. 22.2% increase

B. 22.2% decrease

C. 18.2% decrease

D. 18.2% decrease

Answer: A

Watch Video Solution

88. A source of sound produces waves of wave length $48cm$. This source is moving towards north with speed $1/4$ th that of sound the apparent wave length of the waves to an observer standing south of the moving source will be

A. $60cm$

B. $72cm$

C. $48cm$

D. $96cm$

Answer: A

Watch Video Solution

89. A whistle producing sound waves of frequencies $9500 Hz$ and above is approaching a stationary person with speed $v ms^{-1}$. The velocity of sound in air is $300 ms^{-1}$. If the person can hear frequencies upto a maximum of $10,000 Hz$.The maximum value of v upto which he can hear whistle is

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

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

C. $15 ms^{-1}$

D. $30ms^{-1}$

Answer: C

Watch Video Solution

90. A whistle of frequency 540 Hz rotates in a horizontal circle of radius 2 m at an angular speed of 15 rad//s. The highest frequency heard by a listener at rest with respect to the centre of circle (velocity of sound in air = $300ms^{-1}$)

A. $590 Hz$

B. $594 Hz$

C. $598 Hz$

D. $602 Hz$

Answer: B

Watch Video Solution

91. If a source emitting waves of frequency f moves towards an observer with a velocity $v/3$ and the observer moves away from the source with a velocity $v/4$, the apparent frequency as heard by the observer will be ($v =$ velocity of sound)

A. $9f/8$

B. $8f/9$

C. $3f/4$

D. $4f/3$

Answer: A

View Text Solution

92. The velocity of a listener who is moving away from a stationary source of sound such that the listener notices 5% apparent decrease in frequency of sound is

(Velocity of sound in air $= 340 m/s$)

A. $12.5 ms^{-1}$

B. $17 ms^{-1}$

C. $25 ms^{-1}$

D. $34 ms^{-1}$

Answer: B

View Text Solution

93. Two trains are moving towards each other on parallel tracks at speeds of $144 kmph$ and $54 kmph$. The first train sounds a whistle of frequency $600 Hz$. Frequency of the whistle as heard by a passenger in the second train is ($V = 340 m/s$)

A. $510 Hz$

B. $610 Hz$

C. $710 Hz$

D. $810Hz$

Answer: C

Watch Video Solution

94. A boy sitting on a swing which is moving to an angle of 30° from the vertical is blowing a whistle which is of frequency $1000Hz$. The whistle is $2m$ from the point of support of the swing. If a girl stands in front of the swing, the maximum and minimum frequencies she will hear are

(velocity of sound $= 330 m/s, g = 9.8 m/s^2$)

A. $1000, 990 Hz$

B. $1007, 1000 Hz$

C. $1007, 993 Hz$

D. $1100, 900 Hz$

Answer: C

Watch Video Solution

95. A source of sound produces waves of wave length $48cm$. This source is moving towards north with speed $V/4$ where V is speed of sound. The apparent wavelength of the waves to an observer standing south of the moving source will be

A. $48cm$

B. $60cm$

C. $72cm$

D. $96cm$

Answer: B

Watch Video Solution

96. A siren of frequency n approaches a stationary observer and then receedes from the observer. If the velocity of source $(V) < \; <$ the velocity of sound (C), the apparent change in frequency is

A. $2nV/C$

B. $2nC/V$

C. n/V

D. $2VC/n$

Answer: A

View Text Solution

97. Two sources S_1 and S_2 of sound having frequencies 338, 342 Hz are separated by a large distance. The speed of sound is 340 m/s. The velocity of the observer who is moving from S_2 to S_1 so that he does not hear any beats is

A. $1m/s$

B. $2m/s$

C. $3m/s$

D. $4m/s$

Answer: B

Watch Video Solution

98. A vehicle moving on a straight road sounds a whistle of frequency $256 Hz$ while nearing a hill with a velocity $10 ms^{-1}$. The number of beats per second observed by a person travelling in the vehicle is $\left(V = 330 ms^{-1}\right)$

A. zero

B. 10

C. 14

D. 16

Answer: A

View Text Solution

99. If a vibrating tuning fork of frequency $255Hz$ is approaching with a velocity $4m/s$ perpendicular to a wall. The number of beats produced per sec is (speed of sound in air $= 340m/s$)

A. 3

B. 4

C. 5

D. 6

Answer: D

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100. Two sources A and B are sounding notes of frequency 680 Hz. A listener moves from A to B with a constant velocity u. If the speed of sound is 340 m/s, What must be the value of u so that he hears 10 beats per second?

A. $2.0ms^{-1}$

B. $2.5ms^{-1}$

C. $3.0ms^{-1}$

D. $3.5ms^{-1}$

Answer: B

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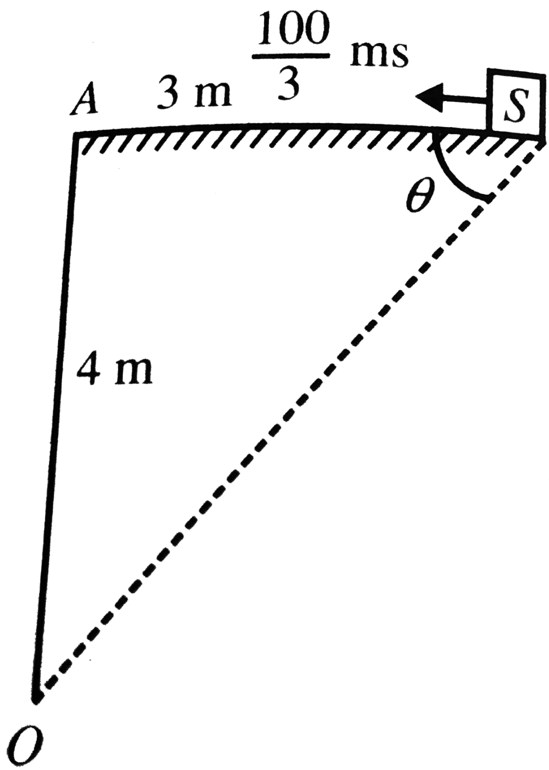

101.

A source of sound S is travelling at $\frac{100}{3}\frac{m}{s}$ along a road, towards a point A. When the source is 3 m away from A, a person standint at a point O on a road perpendicular to AS hears a sound of requency v'. The distance of O from A at that time is 4 m. If the original frequency is 640 Hz, then the value of v' is (velocity of sound is $340\frac{m}{s}$)

A. $620Hz$

B. $680Hz$

C. $720Hz$

D. $840Hz$

Answer: B

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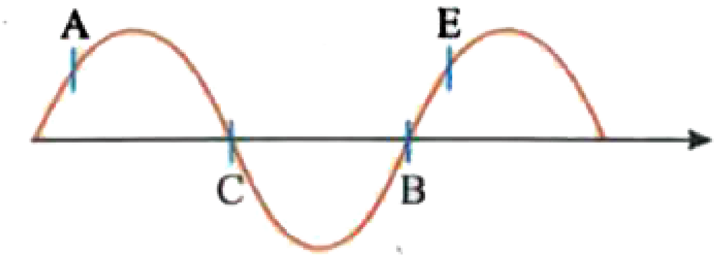
Exercise-II (C.W)

1. Figure shows the shape of a string , the pairs of points which are in opposite phase is



A. A and B

B. B and C

C. C and E

D. A and `E

Answer: B

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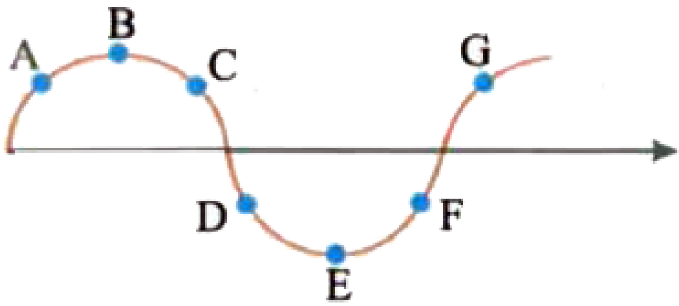
2. Transverse waves are produced in a long string by attaching its free end to a vibrating tuning fork. Figure shows the shape of a part of the string . The points in phase are



A. A and D

B. B and E

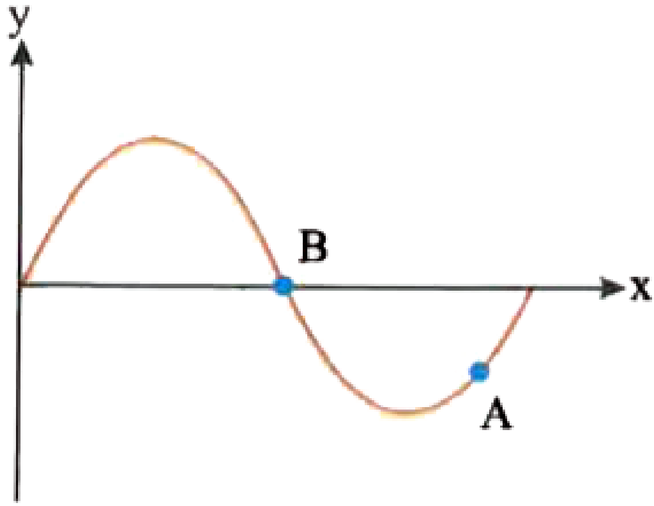
C. C and F

D. A and `G

Answer: D

View Text Solution

3. y - x graph of a transverse wave at a given instant is shown in figure. Match the following two columns.



A. a - r, b - p, c - rd - s

B. a - p, b - p, c - p, d - r

C. a - r, b - s, c - q, d - p

D. a - q, b - p, c - s, d - r

Answer: D

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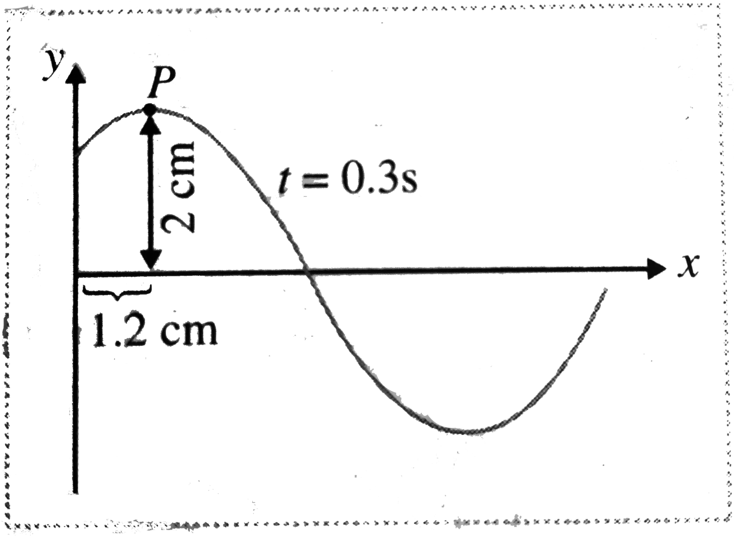
4. Shows a snapshot of a travelling wave taken at $t = 0.3s$. The wavelength is 7.5 cm and amplitude is 2 cm. if the crest P was at x=0 at t=0, write the equation of travelling wave.



A. $y = 2\sin\left(\frac{4\pi}{15}x - \frac{16\pi}{15}t\right)$

B. $y = 2\cos\left(\frac{16\pi}{15}t - \frac{4\pi}{15}x\right)$

C. $y = 2\sin\left(\frac{16\pi}{15}t - \frac{4\pi}{15}x\right)$

D. $y = -2\cos\left(\frac{16\pi}{15}t - \frac{4\pi}{15}x\right)$

Answer: B

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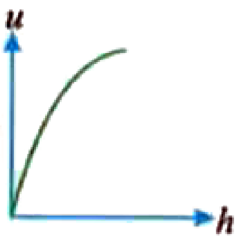
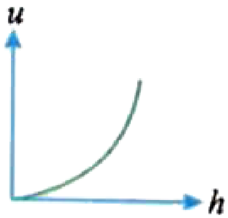
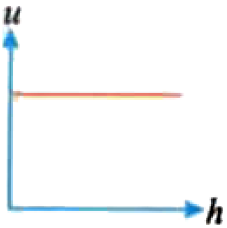
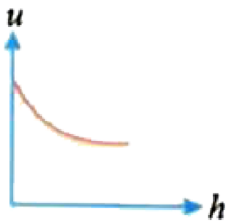
5. A uniform rope having some mass hinges vertically from a rigid support. A transverse wave pulse is produced at the lower end. The speed (v) of the wave pulse varies with height (h) from the lower end as :-

A. 

B. 

C. 

D. 

Answer: A

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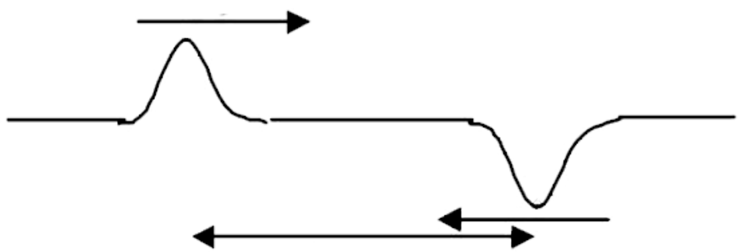
6. Two pulse in a stretched string whose centers are initially $8cm$ apart are moving towards each other as shown in the figure. The speed of each pulse is $2cm/s$. After $2seconds$, the total energy of the pulse will be



A. Zero

B. Purely kinetic

C. Purely potential

D. Partly kinetic and partly potential

Answer: B

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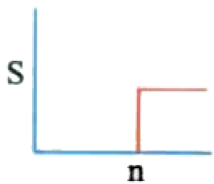
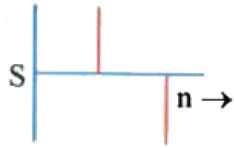
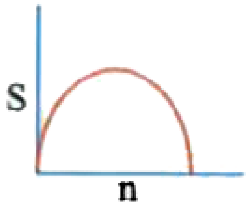
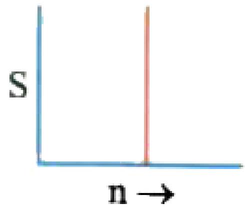
7. The graph between distance between source and observer and apparent frequency in the case of Doppler's effect will be

A. 

B. 

C. 

D. 

Answer: D

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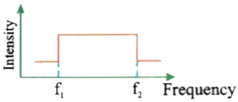
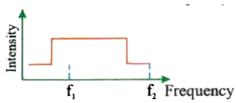
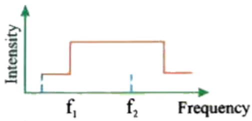
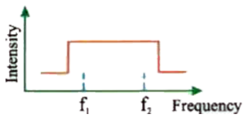
8. The distribution of the sound intensity of the whistle as observed by the passengers in train A is best represented by

A. 

B. 

C. 

D. 

Answer: A

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9.

List – I	List – II
In a stretched string	% Change in frequency
a) Length increases by 2%	e) Decreases by 4%
b) Radius increases by 4%	f) Increases by 1%
c) Tension increases by 2%	g) Decreases by 2%
d) Density decreases by 2%	h) Increases by 1%
	i) Changes by 8%

The correct match is

A. a - g, b - e, c - h, d - f

B. a - h, b - i, c - g, d - h

C. a - e, b - g, c - f, d - h

D. a - f, b - i, c - e, d - g

Answer: A

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10. Transverse waves are produced in a stretched wire. Both ends of the string are fixed. Let us compare between second overtone mode (in numerator) and fifth harmonic, mode (in denominator).

match the following column-I with column-II

Column-I	Column-II
(A) Frequency ratio	(p) $\frac{2}{3}$
(B) Number of nodes ratio	(q) $\frac{4}{5}$
(C) Number of antinodes ratio	(r) $\frac{3}{5}$
(D) Wavelength ratio	(s) $\frac{5}{3}$

A. a - r, b - p, c - r, d - s

B. a - q, b - p, c - s, d - s

C. a - r, b - s, c - q, d - p

D. a - s, b - p, c - r, d - p

Answer: A

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11. A wave travels from a denser medium to rarer medium, then match the following two columns

Column - I	Column - II
(a) speed of wave	(p) will increase
(b) wavelength of wave	(q) will decrease
(c) amplitude of wave	(r) will remain constant
(d)frequency of wave	(s) may increase or decrease

A. a - r, b - p, c - r, d - s

B. a - p, b - p, c - q, d - r

C. a - r, b - s, c - q, d - p

D. a - s, b - p, c - r, d - p

Answer: B

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12. A tuning fork 'P' of frequency $280Hz$ produces 6 beats/s with unknown tuning fork

'Q'

Column-I	Column-II
A) P is waxed and number of beats decreases	P) Frequency of 'Q' is 286 Hz
B) Q is filed and numbered beats Hz decreases	Q) Frequency of 'Q' is 274
C) P is filed and number of beats remains same	R) Frequency of'Q' is 272 Hz
D) 'Q' is filed and number of beats increase	S) Frequency 'Q' is 288 Hz

A. $\begin{matrix} A & B & C & D \\ Q & R & S & R \end{matrix}$

B. $\begin{matrix} A & B & C & D \\ Q & R & Q & P \end{matrix}$

C. $\begin{matrix} A & B & C & D \\ P.Q & Q.R & R.S & P \end{matrix}$

D. $\begin{matrix} A & B & C & D \\ R.S & Q.R & S & R \end{matrix}$

Answer: B

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13. A string of length 1 is stretched along the x-axis and is rigidly clamped at $x = 0$ and $x = 1$. Transverse vibrations are produced in the string. For n^{th} harmonic which of the following relations may represents the shape of the string at any time

(a) $y = 2A\cos\omega t\cos\left(\frac{n\pi x}{l}\right)$

(b) $y = 2A\sin\omega t\cos\left(\frac{n\pi x}{l}\right)$

$(c) y = 2A\cos\omega t\sin\left(\frac{n\pi x}{l}\right)$

$(d)\ y = 2A\sin\omega t\sin\left(\frac{n\pi x}{l}\right)$

A. c only

B. c and d only

C. a only

D. a, b, c and d

Answer: B

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14. The tension in a stretched string fixed at both ends is changed by 2%, the fundamental frequency is found to get changed by $15 Hz$.

(a) wavelength of the string of fundamental frequency does not change

(b) velocity of propagation of wave changes by 2%

(c) velocity of propagation of wave changes by 1%

(d) original frequency is $1500 Hz$

A. c only correct

B. c and d are correct

C. a, c and d are correct

D. b and d are correct

Answer: C

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15. The equation of the standing wave in a string clamped at both ends, vibrating in its third harmonic is given by

$y = 0.4\sin(0.314x)\cos(600\pi t)$

where, x and y are in cm and t in sec.

(a) the frequency of vibration is $300Hz$

(b) the length of the string is $30cm$

(c) the nodes are located at $x = 0, 10cm, 30cm$

A. Only a is true

B. a, b are true

C. b, c are true

D. a, b, c are true

Answer: D

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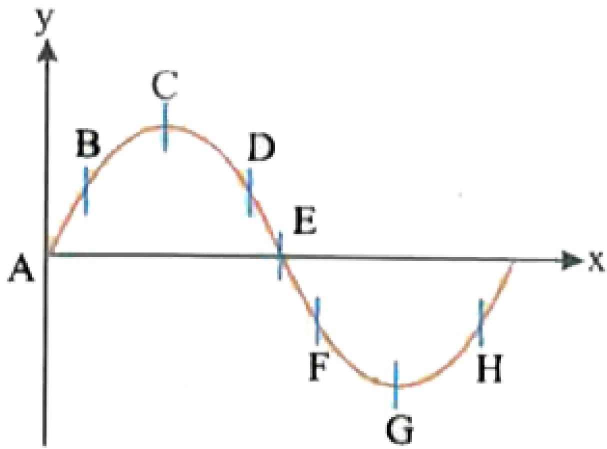
Exercise-II (H.W)

1. A transverse wave is travelling along a string from left to right. The figure below represents the shape of the string at a given instant. At this instant the points have an upward velocity are (here X-wave displacement, Y-particle displacement)



A. D, E, F

B. A, B, H

C. B, D, F

D. A, E, H

Answer: A

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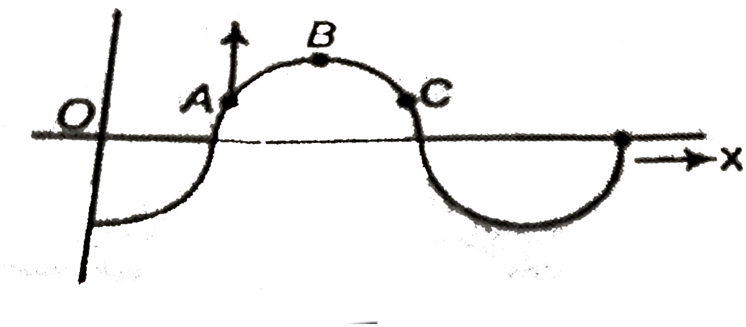
2. At any instant a wave travelling along the string shown in figure. Here, point A is moving upward. Which of the following statement is true?



A. the wave is travelling to the light

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

C. at this instant, C also directed upward

D. 1 and 3

Answer: B

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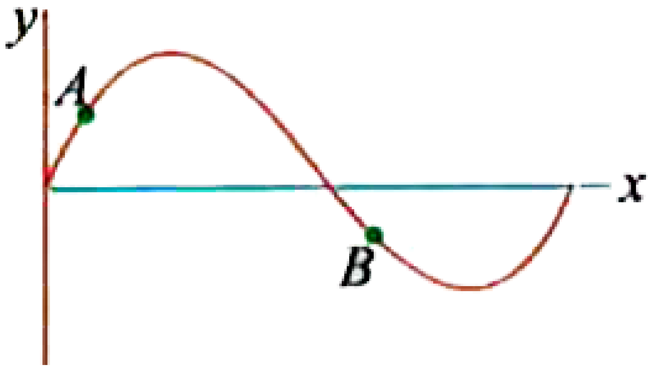
3. The figure shows an instantaneous profile of a rope carrying a progressive wave moving from left to right, then



(a) the phase at A is greater than the phase at B

(b) the phase at B is greater than the phase at A

(c) A is moving upwards

(d) B is moving upwards

A. a and c

B. a and d

C. b and c

D. b and d

Answer: D

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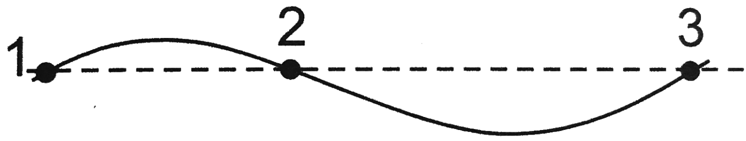
4. 

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. 1 → 2 → 3 →

B. → ← →

C. ↓ ↓ ↓

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

Answer: D

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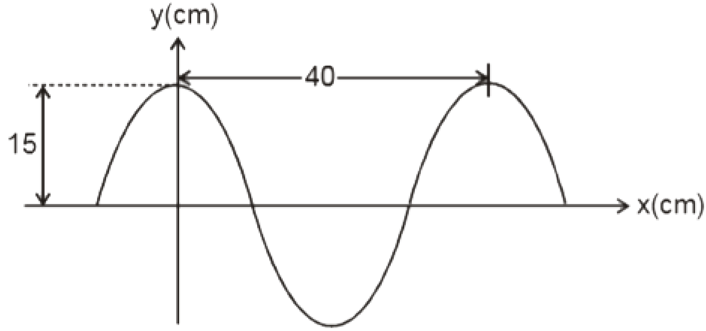
5. A sinusoidal wave travelling in the positive x direction has an amplitude of 15 cm, wavelength 40 cm and frequency 8 Hz. The vertical displacement of the medium at t =0 and x = 0 is also 15 cm, as shown



(b) Determine the phase constant ϕ, and write a general expression for the wave function.

A. $\frac{\pi}{2}$, $\cos\left(16\pi t - \frac{\pi}{20}x\right)$

B. 0, $\sin\left(16\pi t - \frac{\pi}{20}x\right)$

C. $\frac{\pi}{2}$, $\sin\left(16\pi t - \frac{\pi}{20}x\right)$

D. $\frac{\pi}{4}$, $\sin\left(16\pi t - \frac{\pi}{20}x + \frac{\pi}{4}\right)$

Answer: A

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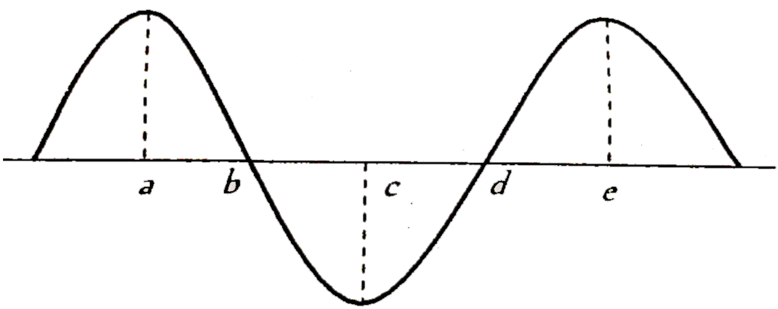
6. The rope shown at an instant is carrying a wave travelling towards right, created by a source vibrating at a frequency n . Consider the following statements



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. I, II and III

B. II only

C. I and III

D. III only

Answer: C

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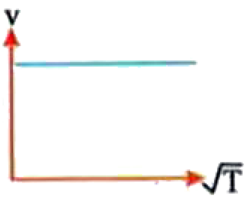
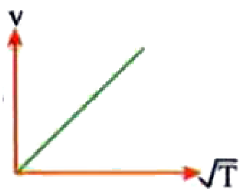
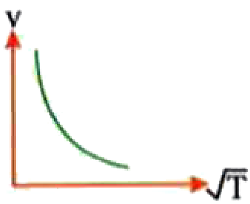
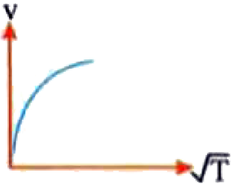
7. Of the following the graph that better represents the variation of frequency 'v' of a vibrating string with the square root of tension $\sqrt{T}$ is

A. 

B. 

C. 

D. 

Answer: B

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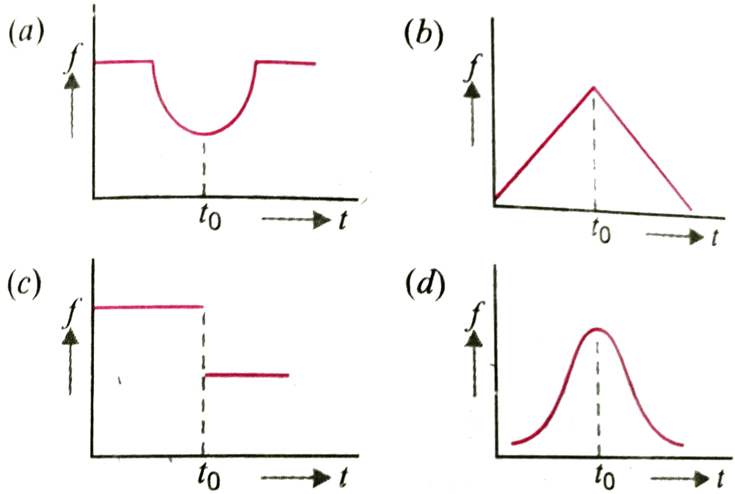
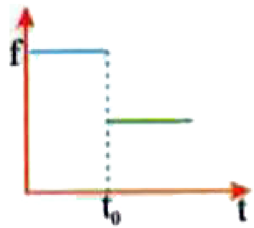
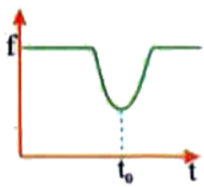
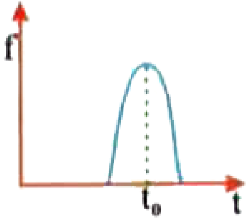
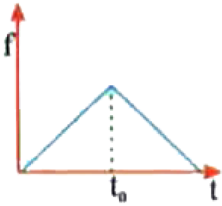
8. A man is standing on a railway platform listening to the whistle of an engine, that passes the man at constant speed without stopping. If the engine passes the man at time t_0, how does the frequency f of the whistle as head by the man changes with time ?



A. 

B. 

C. 

D. 

Answer: A

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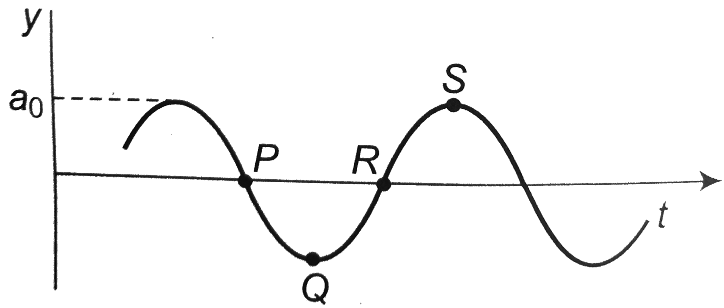
9. 

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 $x = \dfrac{\pi}{2k}$ at time $t = 0$?

A. P

B. Q

C. R

D. S

Answer: B

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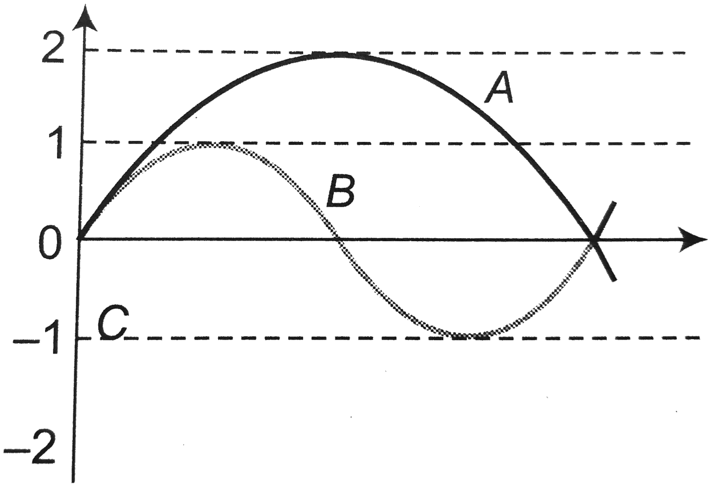
10. 

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. $1:4$

B. $1:16$

C. $1:2$

D. $1:1$

Answer: D

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11. A string of length $1m$ stretched at both ends vibrating with frequency $300Hz$ which is 3

times the fundamental frequency

Column-I	Column-II
A) Number of loops	P) $\frac{1}{3}m$
B) Number of antinodes	Q) 200 Hz
C) Distance between two successive antinodes	R) 1st overtone
D) 2nd harmonic	S) 3

	A	B	C	D
1)	Q	R,S	P,R	Q,S
2)	T	Q,R	P	S,T
3)	P,Q	R,S	P,R,T	Q
4)	S	S	P	Q,R

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12. Match the following

Column-I	Column-II
A) Beats	P) Ratio of harmonics is 1:2:3
B) open organ pipe	Q) Transverse stationary waves
C) string stretched at both ends	R) Superposition of sound waves of nearly equal frequencies
D) closed organ pipe	S) longitudinal stationary waves
	T) Interference in time

	A	B	C	D
1)	R,T	P,S	P,Q	S
2)	Q,R	S,T	R,S,T	Q
3)	S,T	Q,R,T	P	Q
4)	Q	P,Q	R,S	T

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13. Match the following

Column-I	Column-II
A) Laplace equation	P) humidity
B) Newton equation	Q) $\sqrt{\frac{\gamma P}{d}}$
C) Speed of longitudinal wave depends on	R) Temperature
	S) isothermal proces
	T) $\sqrt{\frac{P}{d}}$

	A	B	C
1)	P	Q	S,T
2)	Q	S,T	P,R
3)	P,Q	R,S	T
4)	Q,R	P,Q,R	R,S

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14.

List – I	List – II
a) Resonance	e) Law of conservation of energy
b) Reflection	f) Doppler effect is due to change in wave length
c) Source is in motion	g) Doppler effect is due to number of waves reaching the observer
d) Observer is in motion	h) Special case of forced vibrations
	i) Reverberation

A. a - e, b - h, c - g, d - i

B. a - f, b - g, c - e, d - h

C. a - g, b - h, c - e, d - f

D. a - h, b - i, c - f, d - g

Answer: D

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15. In case of superposition of waves (at $x = 0$),

$y_1 = 4\sin(1026\pi t)$ and $y_2 = 2\sin(1014\pi t)$

(a) the frequency of resulting wave is $510Hz$

(b) the amplitude of resulting wave varies at frequency $3Hz$

(c) the frequency of beats is 6 per second

(d) the ratio of maximum to minimum intensity is 9

The correct statements are

A. a, d

B. b, d

C. a, c, d

D. all

Answer: A

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16. In case of stationary sound waves in air the correct statements(s) is a/are

(A) each air particle vibrates with the same amplitude

(B) amplitude is maximum for some particles and minimum for some other particles

(C) the particles do not execute periodic motion

(D) phase of particles in a loop is same

A. A, C

B. B, D

C. C, D

D. B, C

Answer: B

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

A. a, c are correct

B. b, c are correct

C. a, d are correct

D. all are correct

Answer: C

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Exercise-III

1. Which of the following statements is true ?

A. Both light and sound waves in air are transverse

B. The sound waves in air are logitudinal while the light waves are transverse

C. Both light and sound waves in air aire logitudinal

D. Both light and sound waves can travel in vacuum

Answer: B

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2. A transverse wave propagating along x-axis is represented by:

$y(x, t) = 8.0\sin\left(0.5\pi x - 4\pi t - \frac{\pi}{4}\right)$ Where x is in metres and t is in seconds. The speed of the wave is:

A. $4\pi m/s$

B. $0.5\pi m/s$

C. $\frac{\pi}{4} m/s$

D. $8 m/s$

Answer: D

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3. Two sound waves with wavelengths $5.0m$ and $5.5m$ respectively, each propagates in a gas with velocity $30m/s$ We expect the following number of beats per second:

A. 12

B. 0

C. 1

D. 6

Answer: D

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4. Velocity of star is $10^6 m/s$ and frequency of emitted light is $4.5X10^{14}Hz$. If star is moving away, then apparent frequency will be

A. $4.5Hz$

B. $4.5 \times 10^{16}Hz$

C. $4.485X10^{14}Hz$

D. $4.5X10^8Hz$

Answer: C

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5. A boat at anchore is rocked by waves whose crests are $100m$ apart and velocity is $25m/s$ The boat bounces up once in every

A. $2500s$

B. $75s$

C. $4s$

D. $0.25s$

Answer: C

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6. Which of the following is true regarding beats ?

A. Frequency different, amplitude same

B. Frequency same, amplitude same

C. Frequency same, amplitude different

D. None of the above

Answer: A

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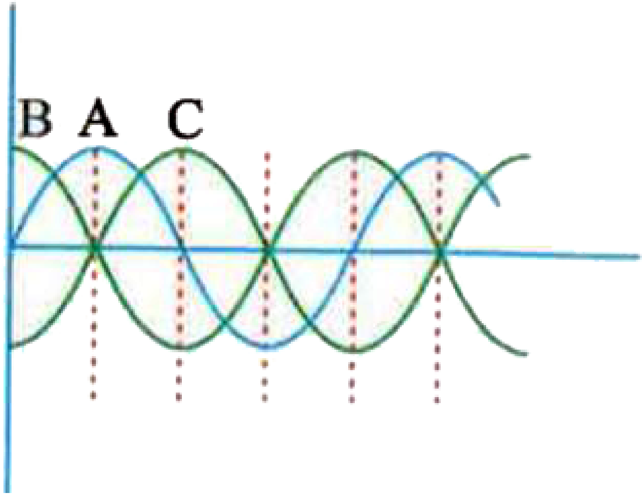
7. Three progressive waves A, B, C are shown in the figure



With respect to A, the progressive wave

A. B lags by $\frac{\pi}{2}$ and C leads by $\frac{\pi}{2}$

B. B lags by π and C leads by π

C. B leads by $\frac{\pi}{2}$ and C lags by $\frac{\pi}{2}$

D. B leads by π and C lags by π

Answer: C

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8. The intensity of sound increases at night due to

A. Increase in density of air

B. decrease in density of air

C. low temperature

D. None of the above

Answer: A

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9. A boat at anchor is rocked by waves whose crests are $100m$ apart and whose speed is $25m/s$. These waves reach the boat once every :

A. 5.0sec

B. 4.0sec

C. 2.0sec

D. 0.25sec

Answer: A

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10. The equation of a wave travelling on a string is $y = 4\sin\left[\frac{\pi}{2}\left(8t - \frac{x}{8}\right)\right]$, where x, y are in cm and t in second. They velocity of the wave is

A. $64 cms^{-1}$ in $-x$ direction

B. $32 cms^{-1}$ in $-x$ direction

C. $32 cms^{-1}$ in $+x$ direction

D. $64 cms^{-1}$ in $+x$ direction

Answer: D

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11. An observer moves towards a stationary source of sound with a speed $\left(\frac{1}{5}\right)$th of the speed of sound. The wavelength and frequency of the source emitted are λ and f, respectively. The apparent frequency and wavelength recorded by the observer are, respectively.

A. $f, 1.2\lambda$

B. $0.8f, 0.8\lambda$

C. $1.2f, 1.2\lambda$

D. $1.2f, \lambda$

Answer: D

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12. Two waves having the intensities in the ratio of $9:1$ produce interference. The ratio of maximum to minimum intensity is equal to

A. $10:8$

B. $9:1$

C. $4:1$

D. $2:1$

Answer: C

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13. The wave decribed by $y = 0.25\sin(10\pi x - 2\pi t)$. Where x and y are in metre and t is second, is a wave travelling along the Therefore, the wave is travelling along $+ve$ x direction with frequency $1Hz$and wavelength $0.2m$

A. - ve x direction with frequency $1Hz$

B. + ve x direction with frequency πHz and

wavelength $\lambda = 0.2m$

C. + ve x direction with frequency $1Hz$ and

wavelength $\lambda = 0.2m$

D. - ve x direction with amplitude $0.2m$

and wavelength $\lambda = 0.2m$

Answer: C

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14. The equation of a simple harmonic wave is given by $Y = 5\sin\frac{\pi}{2}(100t - x)$, where x and y are in metre and time is in second. The time period of the wave (m seconds) will be

A. 0.04

B. 0.01

C. 1

D. 5

Answer: A

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15. A tuning fork A produces 4 beats s^{-1} with another tuning fork B of frequency $320Hz$. ON filing one of the prongs of A, 4 beats s^{-1} are again heard when sounded with the same fork B. Then the frequency of the fork a before filling is

A. $328Hz$

B. $316Hz$

C. $324Hz$

D. $320Hz$

Answer: B

Watch Video Solution

16. Two sound waves of slightly different frequencies propagating in the same direction produce beats due to

A. Interference

B. diffraction

C. reflection

D. refraction

Answer: A

Watch Video Solution

17. Change in frequency due to Doppler's effect is produced when

A. the source and the observer are moving in the same direction

B. the source and the observer are both at rest

C. there is a relative motion between the source the observer

D. there is a resultant motion between the source & observer

Answer: C

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18. Two points are located at a distance of $10m$ and $15m$ from the source of oscillation. The period of oscillation is 0.05s and the velocity of the wave is $300m/s$. What is the phase difference between the oscillation of two points?

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

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

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

D. π

Answer: C

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19. The driver of a car travelling with speed $30ms^{-1}$ towards a hill sounds a horn of frequency 600 Hz. If the velocity of sound in air is $330ms^{-1}$, the frequency of reflected sound as heard by driver is

A. $555.5Hz$

B. $720Hz$

C. $500Hz$

D. $550Hz$

Answer: B

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20. Each of the two strings of length $51.6cm$ and $49.1cm$ are tensioned separately by $20N$ force. Mass per unit length of both the strings is same and equal to $1g/m$. When both the strings vibrate simultaneously, the number of beats is

A. 7

B. 8

C. 3

D. 5

Answer: A

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

A. $1:3:5$

B. $1:2:3$

C. $5:3:1$

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

Answer: D

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22. The ratio of intensities between two coherent sound sources is $4:1$ the difference of loudness in decibels between maximum and minimum intensities, when they interfere in space, is

A. $10\log 2$

B. $20\log 3$

C. $10\log 3$

D. $20\log2$

Answer: A

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

A. $0.4m$ from the open end

B. $0.4m$ from the closed end

C. Both (1) and (2)

D. $0.8m$ from the open end

Answer: A

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24. A wave in a string has an amplitude of $2cm$. The wave travels in the $+ve$ direction of x axis with a speed of $128ms^{-1}$ and it is noted that 5 complete waves fit in $4m$ length of the string. The equation describing the wave is

A. $y = (0.02)m\sin(7.85 + 1005t)$

B. $y = (0.02)m\sin(15.7x - 2010t)$

C. $y = (0.02)m\sin(15.7x + 2010t)$

D. $y = (0.02)m\sin(7.85 - 1005t)$

Answer: D

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25. A tuning fork of frequency 512 Hz makes 4 beats//s with the vibrating string of a piano. The beat frequency decreases to 2 beats//s when the tension in the piano string is slightly increased.The frequency of the piano string before increasing the tension was

A. $510 Hz$

B. $514 Hz$

C. $516 Hz$

D. $508 Hz$

Answer: C

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26. A transverse wave is represented by $y = A\sin(\omega t - kx)$. For what value of the wavelength is the wave velocity equal to the maximum particle velocity?

A. $\pi A/2$

B. πA

C. $2\pi A$

D. A

Answer: C

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27. The equation $y = 4 + 2\sin(6t - 3x)$ represents a wave motion. Then, wave speed and amplitude, respectively are

A. wave speed 1 unit, amplitude 6 unit

B. wave speed 2 unit, amplitude 2 unit

C. wave speed 4 unit, amplitude 1/2 unit

D. wave speed 1/2 unit, amplitude 5 unit

Answer: B

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28. Two waves

$y_1 = A_1 \sin\left(\omega t - \beta_1\right), y_2 = A_2 \sin\left(\omega t - \beta_2\right.$

Superimpose to form a resultant wave whose amplitude is

A. $\sqrt{A_1^2 + A_2^2 + A_1 A_2 \cos\left(\beta_1 - \beta_2\right)}$

B. $\sqrt{A_1^2 + A_2^2 + A_1 A_2 \sin\left(\beta_1 - \beta_2\right)}$

C. $A_1 + A_2 (4) \left|A_1 + A_2\right|$

D. -

Answer: A

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29. A fork A has frequency 2% more than the standard fork and B has a frequency 3% less than the frequency of same standard frok. The forks A and B when sounded together produced 6 beats/s. The frequency of fork A is

A. $116.4Hz$

B. $120Hz$

C. $122.4Hz$

D. $238.8Hz$

Answer: C

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30. Two instruments having stretched strings are being played in unison . When the tension in one of the instruments is increases by $1\%, 3$ beats are produced in $2s$. The initial frequency of vibration of each wire is

A. $600 Hz$

B. $300 Hz$

C. $200 Hz$

D. $150 Hz$

Answer: B

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31. A point source emits sound equally in all directions in a non-absorbing medium. Two point P and Q are at distance of $2m$ and $3m$

respectively from the source. The ratio of the intensities of the wave at P and Q is :

A. $9:4$

B. $2:3$

C. $3:2$

D. $4:9$

Answer: A

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32. Sounds waves travel at $350 m/s$ through a warm air and at $3500 m/s$ through brass. The wavelength of a $700 Hz$. Acoustic wave as it enters brass from warm air

A. Decreases by a factor 20

B. Decreases by a factor 10

C. Increases by a factor 20

D. Increases by a factor 10

Answer: D

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Watch Video Solution

33. A source of sound moves towards an observer with a velocity $108 km/h$ and the observer also moves towards the source with the velocity 5 km/h, then the velocity of sound is

A. $320 ms^{-1}$

B. $330 ms^{-1}$

C. $340 ms^{-1}$

D. Data insufficient

Answer: D

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

A. less than f

B. $equal \rightarrow$ f`

C. $isgreaterthan$f`

D. may be greater than , less than or equal to depending on the factiors like speed of train, length of train and radius of circular track

Answer: D

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35. The equation of a wave is $y = 5\sin\left(\frac{t}{0.04} - \frac{x}{4}\right)$ where x is in cm and t is in seccond. The velocity of the wave will be

A. $1ms^{-1}$

B. $2ms^{-1}$

C. $1.5ms^{-1}$

D. $1.25ms^{-1}$

Answer: D

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36. Two vibrating strings of the same material but lengths L and $2L$ have radii $2r$ and r respectively. They are stretched under the same tension. Both the string vibrate in their fundamental nodes, the one of length L with freuqency v_1 and the other with frequency v_2. the ratio v_1/v_2 is given by

A. 2

B. 4

C. 3

D. 1

Answer: D

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37. Two waves are represented by the equations

$y_1 = a\sin(\omega t + kx + 0.57)m$ and

$y_2 = a\cos(\omega t + kx)$m,

where x is in metres and t is in seconds. The phase difference between them is

A. 1.25 rad

B. 1.57 rad

C. 0.57 rad

D. 1.0 rad

Answer: D

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38. A source of sound S is moving with a velocity of $50m/s$ towards a stationary observer. The observer measures the frequency of the source as 1000 Hz. What will be the apparent frequency of the source as 1000 Hz. What will be the apparent frequency of the source when it is moving away from the observer after crossing him? The velocity of the sound in the medium is $350 m/s$

A. $750 Hz$

B. $857 Hz$

C. $1143 Hz$

D. $1333 Hz$

Answer: A

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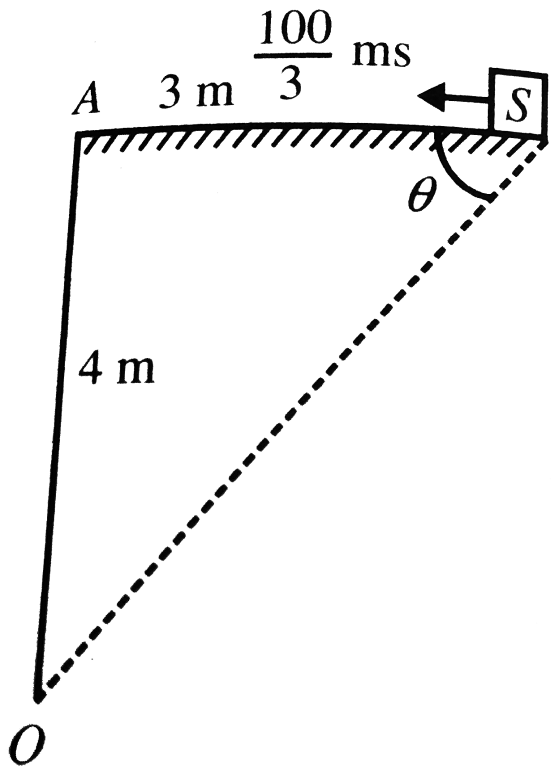

39.

A source of sound S is travelling at $\frac{100}{3}\frac{m}{s}$ along a road, towards a point A. When the source is 3 m away from A, a person standint at a point O on a road perpendicular to AS hears a sound of requency v'. The distance of O from A at that time is 4 m. If the original frequency is 640 Hz, then the value of v' is (velocity of sound is $340\frac{m}{s}$)

A. $620Hz$

B. $680Hz$

C. $720Hz$

D. $840Hz$

Answer: B

Watch Video Solution

40. The equation of a simple harmonic wave is given by

$$y = 3\sin\frac{\pi}{2}(50t - x)$$

where x and y are in meters and x is in second .The ratio of maximum particle velocity to the wave velocity is

A. 2π

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

C. 3π

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

Answer: B

Watch Video Solution

41. A train moving at a speed of $220ms^{-1}$ towards a stationary object emits a sound of frequency 1000 Hz. Some of the sound reaching the object gets reflected back to the train as echo. The frequency of the echo as detected by the driver of the train is (speed of sound in air is $330 ms^{-1}$)

A. $3500 Hz$

B. $4000 Hz$

C. $5000 HZ$

D. $3000 Hz$

Answer: C

Watch Video Solution

42. When a string is divided into three segments of lengths l_1, l_2 and l_3 the fundamental frequencies of these three segments are v_1, v_2 and v_3 respectively.

The original fundamental frequency (v) of the string is

A. $v = v_1 + v_2 + v_3$

B. $\frac{1}{v} = \frac{1}{v_1} + \frac{1}{v_2} + \frac{1}{v_3}$

C. $\frac{1}{\sqrt{v}} = \frac{1}{\sqrt{v_1}} + \frac{1}{\sqrt{v_2}} + \frac{1}{\sqrt{v_3}}$

D. $\sqrt{v} = \sqrt{v_1} + \sqrt{v_2} + \sqrt{v_3}$

Answer: B

Watch Video Solution

43. Two sources of sound placed closed to each other, are emitting progressive waves given by

$y_1 = 4\sin 600\pi t$

and $y_2 = 5\sin 608\pi t$

An observer located near these two sources of sound will hear

A. 8 beats per second with itensity ratio $25 : 16$ between waxing and waning

B. 8 beats per second with itensity ratio $81 : 1$ between waxing and waning

C. 4 beats per second with itensity ratio $81 : 1$ between waxing and waning

D. 4 beats per second with itensity ratio $25 : 16$ between waxing and waning

Answer: C

Watch Video Solution

44. If we study the vibration of a pipe open at both ends, then the following statements is not true

A. Odd harmonics of the fundamental frequency will be generated

B. All harmonics of the fundamental frequency will be generated.

C. Pressure change will be maximum at both end.

D. Open end will be antimode

Answer: C

Watch Video Solution

45. A source of unknown frequency gives 4 beats//s, when sounded with a source of known frequency 250 Hz. The second harmonic of the source of unknown frequency gives five beats per second, when sounded with a source of frequency 513 The unknown frequency is

A. $246 Hz$

B. $240 Hz$

C. $260 Hz$

D. $254 Hz$

Answer: D

Watch Video Solution

46. A wave travelling in the $+ve$ x-direction having displacement along y-direction as $1m$, wavelength 2π m and frequency of $1/\pi$ Hz is represented by

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

B. $y = \sin(10\pi x - 20\pi t)$

C. $y = \sin(2\pi x + 2\pi t)$

D. $y = \sin(x - 2t)$

Answer: D

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Watch Video Solution

47. If $n_1, n_2 \text{and} n_3$ are the fundamental frequencies of three segments into which a string is divided, then the original fundamental frequency n of the string is given by

A. $n = n_1 + n_2 + n_3$

B. $\frac{1}{n} = \frac{1}{n_1} + \frac{1}{n_2} + \frac{1}{n_3}$

C. $\frac{1}{\sqrt{n}} = \frac{1}{\sqrt{n_1}} + \frac{1}{\sqrt{n_2}} + \frac{1}{\sqrt{n_3}}$

D. $\sqrt{n} = \sqrt{n_1} + \sqrt{n_2} + \sqrt{n_3}$

Answer: B

Watch Video Solution

48. A speed ign motorcyclist sees traffic ham ahead of him. He slows doen to $36km/h$ He finds that traffic has eased and a car moving ahead of him at $18km/h$ is honking at a frequency of 1392 Hz. If the speed of sound is $343m/s$, the frequency of the honk as heard by him will be

A. $1454Hz$

B. $1332Hz$

C. $172Hz$

D. $1412Hz$

Answer: D

Watch Video Solution

49. The number of possible natural oscillations of air column in a pipe closed at one end of length 85 cm whose frequencies lie below 1250 Hz are (velocity of sound $= 340 ms^{-1}$).

A. 6

B. 4

C. 5

D. 7

Answer: A

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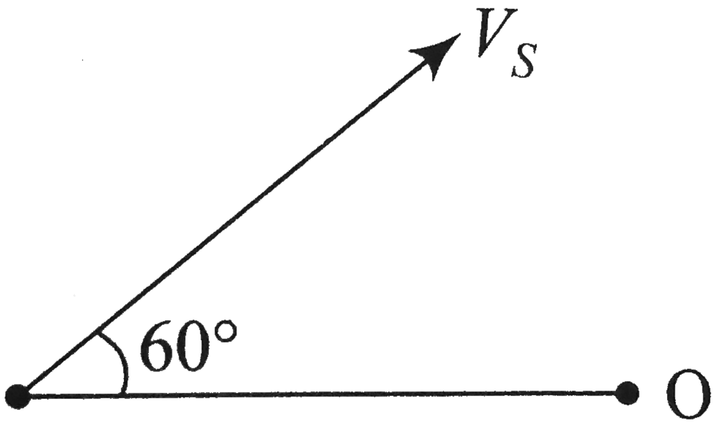
50.



A source of sound S emitting waves of frequency $100Hz$ and an observer O are located at some distance from each other. The source is moving with a speed of $19.4ms^{-1}$ at an angle of 60° with the source observer line as shown in the figure. The observer is at rest. The apparent frequency observed by the observer (velocity of sound in air $330ms^{-1}$) is

A. $97Hz$

B. $100Hz$

C. $103Hz$

D. $106Hz$

Answer: C

Watch Video Solution

51. A string is stretched between fixed points separated by $75.0cm$. It is observed to have resonant frequencies of $420Hz$ and $315Hz$.

There are no other resonant frequencies between these two. Then, the lowest resonant frequency for this string is

A. $105 Hz$

B. $155 Hz$

C. $205 Hz$

D. $10.5 Hz$

Answer: A

Watch Video Solution

52. The fundamental frequency of a closed organ pipe of length $20cm$ is equal to the second overtone of an organ pipe open at both the ends. The length of organ pipe open at both the ends is

A. $140cm$

B. $80cm$

C. $100cm$

D. $120cm$

Answer: D

Watch Video Solution

53. Three sound waves of equal amplitudes have frequencies (n-1) ,n (n+1) .They superimpose to give beats.The number of beats produced per second will be

A. 3

B. 2

C. 1

D. 4

Answer: B

Watch Video Solution

54. The second overtone of an open organ pipe has the same frequency as the first overtone of a closed pipe L metre long. The length of the open pipe will be

A. $L/2$

B. $4L$

C. L

D. $2L$

Answer: D

Watch Video Solution

55. A siren emitting a sound of frequency 800 Hz moves away from an observer towards a cliff at a speed of $15ms^{-1}$. Then the frequency of sound that the observer hears in the echo reflected from the cliff is (Take velocity of sound in air $= 330ms^{-1}$)

A. $885Hz$

B. $765Hz$

C. $800Hz$

D. $838Hz$

Answer: D

Watch Video Solution

56. A uniform rope of legnth L and mass m_1 hangs vertically from a rigid support. A block of mass m_2 is attached to the free end of the rope. A transverse pulse of wavelength λ_1 is produced at the lower end of the rope. The wavelength of the pulse when it reaches the top of the rope is λ_2. The ratio $\frac{\lambda_2}{\lambda_1}$ is

A. $\sqrt{\frac{m_1 + m_2}{m_1}}$

B. $\sqrt{\frac{m_1}{m_2}}$

C. $\sqrt{\frac{m_1 + m_2}{m_2}}$

D. $\sqrt{\frac{m_2}{m_1}}$

Answer: C

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Exercise-IV

1. The transverse displacement $y(x, t)$ of a wave on a string is given by $y(x, t) = e^{-\left(ax^2 + bt^2 + 2\sqrt{(ab)}xt\right)}$. This represents a :

A. Wave movinig in -ve x direction with speed $\sqrt{b/a}$

B. Wave moving in + ve x direction with speed $\sqrt{b/a}$

C. Standing wave of frequency $\sqrt{b}$

D. Standing wave of frequency $\frac{1}{\sqrt{b}}$

Answer: A

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2. A travelling wave pulse is given by

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

where x and y are in metre and t is in second.

The velocity of wave is :-

A. 4m/s

B. 2m/s

C. 8m/s

D. 12m/s

Answer: A

Watch Video Solution

3. Two sinusoidal waves are superposed. Their equations are

$y_1 = A\sin\left(kx - \omega t + \frac{\pi}{6}\right)$ and $y_2 = A\sin\left(kx - \omega t - \frac{\pi}{6}\right)$

the equation of their resultant is

A. $y = \frac{A}{\sqrt{3}}\sin(kx - \omega t)$

B. $y = A\sqrt{3}\sin(kx - \omega t)$

C. $y = A\sqrt{3}\sin\left(kx - \omega t - \frac{\pi}{3}\right)$

D. $y = \frac{A}{\sqrt{3}}\sin\left(kx - \omega t - \frac{\pi}{3}\right)$

Answer: B

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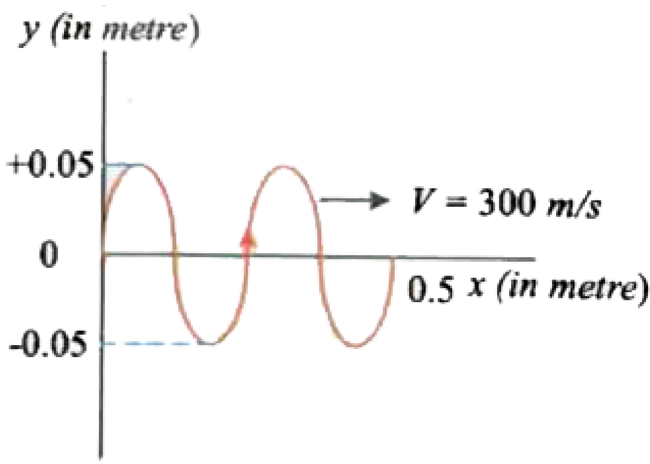
4. A plane progressive wave is shown in the adjoining phase diagram. The wave equation of this wave, if its position is shown at $t = 0$,is



A. $y = 0.05\sin 2\pi(300t - x)$

B. $y = 0.05\sin 2\pi(300t + x)$

C. $y = 0.05\sin 8\pi(300t + x)$

D. $y = 0.05\sin 8\pi(300t - x)$

Answer: D

Watch Video Solution

5. Intensity of a point source of sound is $0.2\frac{W}{m^2}$ at a place. If the distance of source and power are doubled,the intensity at that place becomes to

A. $0.05\frac{W}{m^2}$

B. $0.2\frac{W}{m^2}$

C. $0.1\frac{W}{m^2}$

D. $3.8\frac{W}{m^2}$

Answer: C

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6. the maximum pressure variation that the human ear can tolerate in loud sound is about $30N/m^2$. The corresponding maximum displacement for a sound wave ina air having a frequency of $10^3 Hz$is

take velocity of sound in air as 300 m/s and density of air $1.5kg/m^3$

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

B. $\frac{\pi X10^{-2}}{3}$m

C. $\frac{2X10^{-4}}{\pi}$m

D. $\frac{2\pi X 10^{-2}}{3}$ m

Answer: A

Watch Video Solution

7. A travelling wave represented by

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

is superimposed on another wave represented

by

$y = A\sin(\omega t + kx)$. The resultant is

A. a standing wave

B. a wave travelling along $+x$ direction

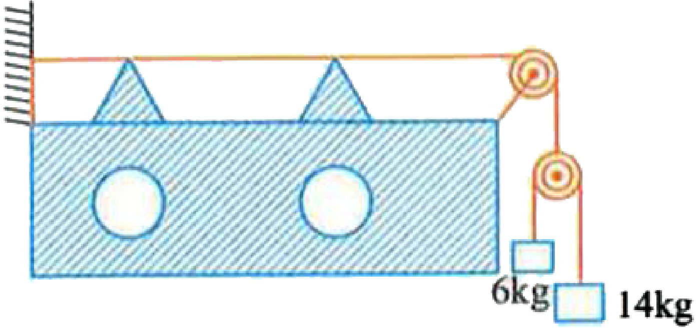
C. a wave travelling along -x direction

D. None of the Above

Answer: A

Watch Video Solution

8. In a sonometer wire, the tension is maintained by suspending a $20kg$ mass from the free end of the wire. The fundamental frequency of vibration is $300Hz$.



If the tension is provided by two masses of $6kg$ and $14kg$ suspended from a pulley as show in the figure the fundamental frequency will

A. still remain $300Hz$

B. become larger

C. become smaller

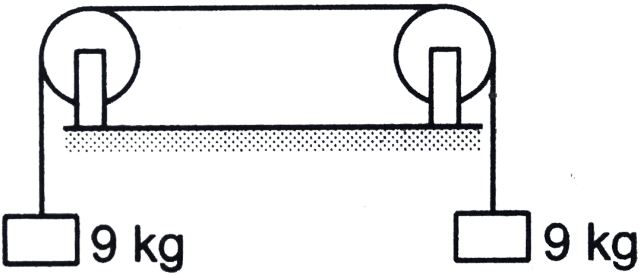
D. decrease in the present situation and increase if the suspended masses of $6kg$

and $14kg$ are interchanged

Answer: C

Watch Video Solution

9. 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.



A. $35 Hz$

B. $40 Hz$

C. $70 Hz$

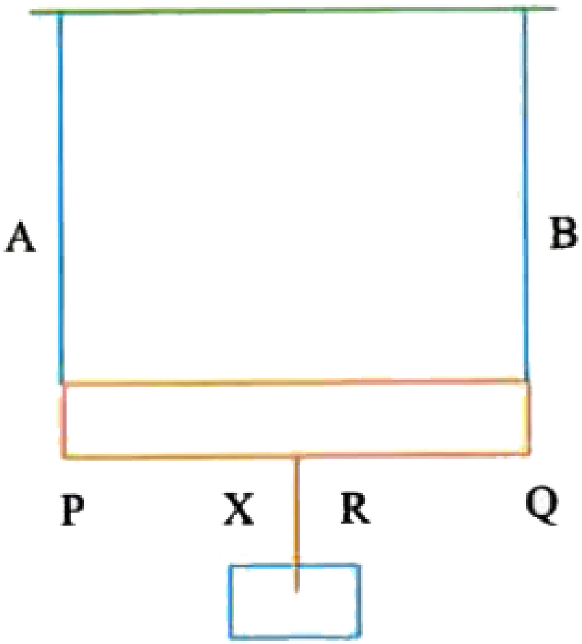
D. $80 Hz$

Answer: C

Watch Video Solution

10. A rod PQ of length 'L' is hung from two identical wires A and B. A block of mass 'm' is hung at point R of the rod as shown in figure. The value of 'x' so that the fundamental mode in wire A is in resonance with first overtone of

B is



A. $\frac{4L}{5}$

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

C. $\frac{L}{5}$

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

Answer: C

Watch Video Solution

11. Two wires are fixed in a sanometer. Their tension are in the ratio $8:1$ The lengths are in the ratio $36:35$ The diameter are in the ratio $4:1$ Densities of the materials are in the ratio $1:2$ if the lower frequency in the setting is $360Hz$. The beat frequency when the two wires are sounded together is

A. $20Hz$

B. $10Hz$

C. $30Hz$

D. $40Hz$

Answer: B

Watch Video Solution

12. A string of mass M as a circular loop rotates abot its axis on a frictionless horizontal plane at a uniform rate so that the tangential plane at a uniform rate so that the tangential speed of any particle of the string is v. If a small transverse disturbance is produced at a point of the loop, then speed (relative to the string) of disturbance on the string is

A. $v\sqrt{\frac{M}{2}}$

B. $\sqrt{2}v$

C. v

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

Answer: C

Watch Video Solution

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

A. $\dfrac{L^2}{L^2 + I^2}$

B. $\dfrac{L^2 - l^2}{L^2}$

C. $\dfrac{L^2}{L^2 - l^2}$

D. $\dfrac{L^2 + l^2}{L^2}$

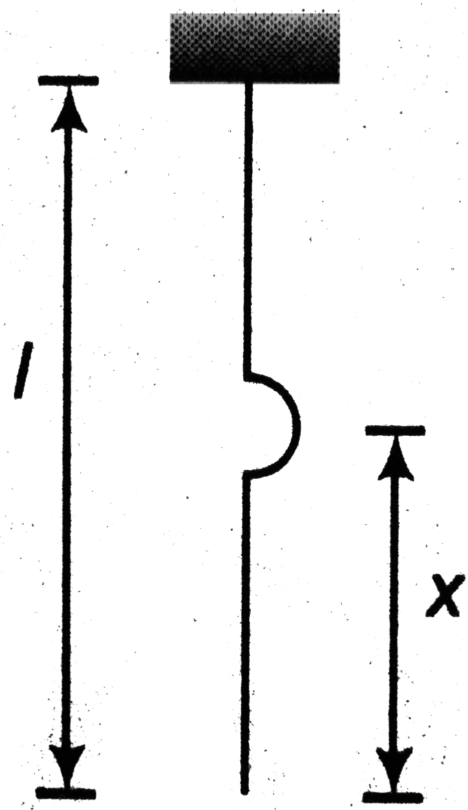
Answer: C

Watch Video Solution

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

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

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



A. $\sqrt{\dfrac{l}{g+a}}$

B. $2\sqrt{\dfrac{l}{g+a}}$

C. $\sqrt{\dfrac{g+a}{l}}$

D. $2\sqrt{\dfrac{g+a}{l}}$

Answer: B

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15. A string of length L is stretched by $L/20$ and speed transverse wave alon it is v. The speed of wave ehen it is stretched by $L/10$ will be (assume that Hooke law is applicable)

A. $2v$

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

C. $\sqrt{2}v$

D. $4v$

Answer: C

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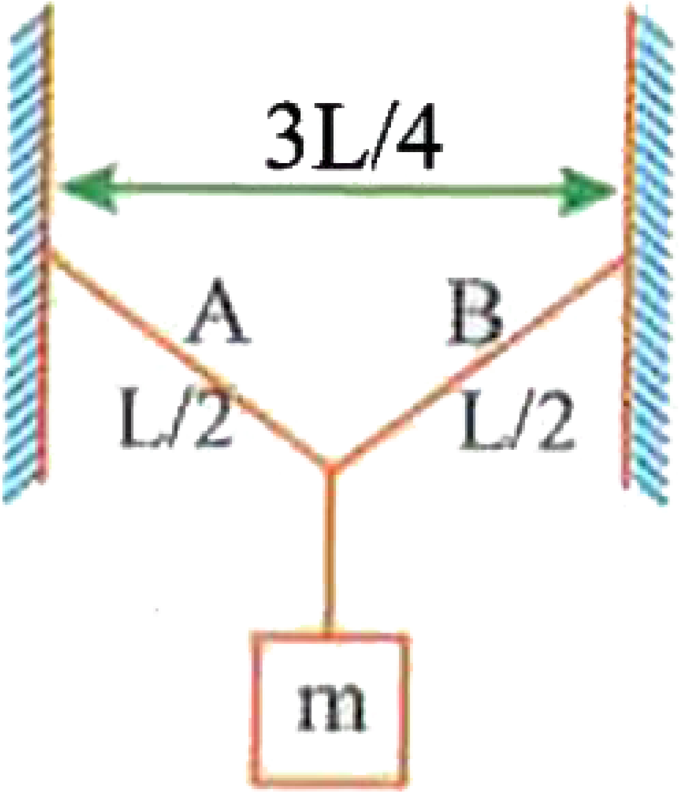
16. Transverse waves pass through the strings A and B attached to an object of mass 'm' as shown. If μ is the linear density of each of the strings, the velocity of the transverse waves produced in the strings A and B is



A. $\sqrt{\frac{mg}{\mu}}$

B. $\sqrt{\frac{2mg}{\mu}}$

C. $\sqrt{\frac{\sqrt{7}mg}{2\mu}}$

D. $\sqrt{\frac{2mg}{\sqrt{7}\mu}}$

Answer: D

View Text Solution

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

A. $\dfrac{8f_0\Delta l}{l}$

B. $\dfrac{f_0\Delta l}{l}$

C. $\dfrac{2f_0\Delta l}{l}$

D. $\dfrac{4f_0\Delta l}{l}$

Answer: C

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

A. $1/4$

B. $1/3$

C. $1/2$

D. $2/3$

Answer: C

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19. The displacement y of a particle executing periodic motion is given by

$$y = 4\cos^2\left(\frac{1}{2}t\right)\sin(1000t)$$

This expression may be considereed to be a result of the superposition of

A. two waves

B. three waves

C. five waves

D. four waves

Answer: B

Watch Video Solution

20. If the two waves of the same frequency and same amplitude, on superposition produce a resultant disturbance of the same amplitude, then the phase difference between the two arriving wave will be

A. π

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

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

D. 3π

Answer: B

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21. Three waves of amplitudes $12\mu m$, $4\mu m$ & $9\mu m$ but of same frequency arrive at a point in a medium with a successive phase difference of $\left(\frac{\pi}{2}\right)$. Then the resultant amplitude in μm is

A. 4

B. 7

C. 5

D. 25

Answer: C

Watch Video Solution

22. The ratio of the velocity of sound in Hydrogen gas $\left(\gamma = \frac{7}{5}\right)$ to that in Helium gas $\left(\gamma = \frac{5}{3}\right)$ at the same temperature is $\sqrt{\frac{21}{3}}$.

A. $\sqrt{\frac{21}{5}}$

B. $\frac{\sqrt{21}}{5}$

C. $\frac{21}{5}$

D. $\frac{5}{21}$

Answer: B

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23. How long will it take sound waves to travel a distance l between points A and B if the air temperature between them varies linearly from T_1 and T_2? (The velocity of sound in air at temperature T is given by $v = \alpha\sqrt{T}$, where α is a constant)

A. $t = \dfrac{2l}{\alpha\left[\sqrt{T_2} + \sqrt{T_1}\right]}$

B. $t = \dfrac{4l}{\alpha\left[\sqrt{T_1} + \sqrt{T_2}\right]}$

C. $t = \dfrac{4l}{\alpha\left[\sqrt{T_1}\sqrt{T_2}\right]}$

D. $t = \dfrac{2l}{\alpha\left[\sqrt{T_1} + \sqrt{T_2}\right]}$

Answer: A

Watch Video Solution

24. A wave represented by $y = 100\sin(ax + bt)$ is reflected from a dense plane at the origin.If 36% of energy is lost and rest of the energy is reflected then the equation of the reflected wave will be -

A. $y = -8.1\sin(ax - bt)$

B. $y = 8.1\sin(ax + bt)$

C. $y = -80\sin(ax - bt)$

D. $y = -10\sin(ax - bt)$

Answer: A

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25. In a stationary wave pattern that forms as a result of reflection pf waves from an obstacle the ratio of the amplitude at an antinode and a node is $\beta = 1.5$. What percentage of the energy passes across the obstacle ?

A. $96\ \%$

B. $4\ \%$

C. $94\ \%$

D. $6\ \%$

Answer: C

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26. The vibrations of a string fixed at both ends are represented by $y = 16\sin\left(\frac{\pi x}{15}\right)\cos(96\pi t)$. Where 'x' and 'y' are in cm and 't' in seconds. Then the phase difference between the points at $x = 13cm$ and $x = 16$ in radian is

A. $\pi/5$

B. π

C. 0

D. $2\pi/5$

Answer: A

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27. An open organ pipe of length 1 and fundamental frequency n is gradually dipped into water with uniform speed 'v'. The rate of change in its fundamental frequency is

A. $-\frac{V}{l}v$

B. $-\frac{V}{4l^2}v$

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

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

Answer: B

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28. Air column of $20cm$ length in a resonance tube resonates with a certain tuning fork when sounded at its upper open end. The lower end of the tube is closed and adjustable by changing the quantity of mercury filled inside the tube. The temperature of the air is $27\,^{\circ}C$. The change in length of the air column required, if the temperature falls to $7\,^{\circ}C$ and the same tuning fork is again sounded at the upper open end is nearly

A. $1mm$

B. $7mm$

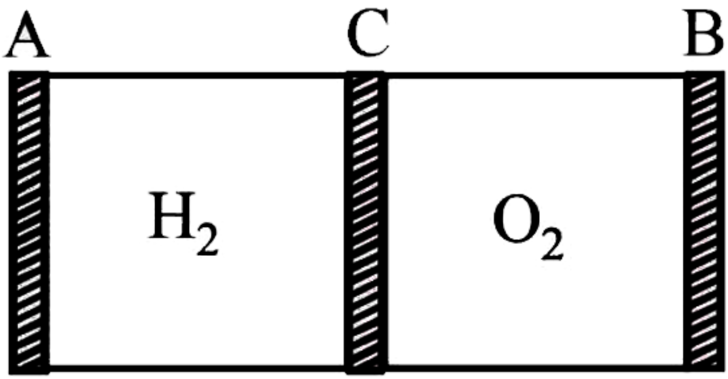
C. $5mm$

D. $13mm$

Answer: B

Watch Video Solution

29. AB is a cylinder of length $1m$ fitted with a thin flexible diaphragm C at the middle and other thin flexible diaphragms A and B at the ends. The portions AC and BC contain hydrogen and oxygen gases respectively. The diaphragms A and B are set into vibrations of same frequency. What is the minimum frequency of these vibrations for which diaphragms C is a node? (Under the conditions of experiment $v_{H_2}=1100m/s$, v_{0_2} = $300m/s$).



A. $1100Hz$

B. $3300Hz$

C. $1650Hz$

D. $1500Hz$

Answer: C

Watch Video Solution

30. While measuring the speed of sound by performing a resonance column experiment, a student gets the first resonance condition at a column length of $18cm$ during winter. Repeating the same experiment during summer, she measures the column length to be xcm for the second resonance. Then

A. $18 > x$

B. $x > 54$

C. $54 > x > 36$

D. $36 > x > 18$

Answer: B

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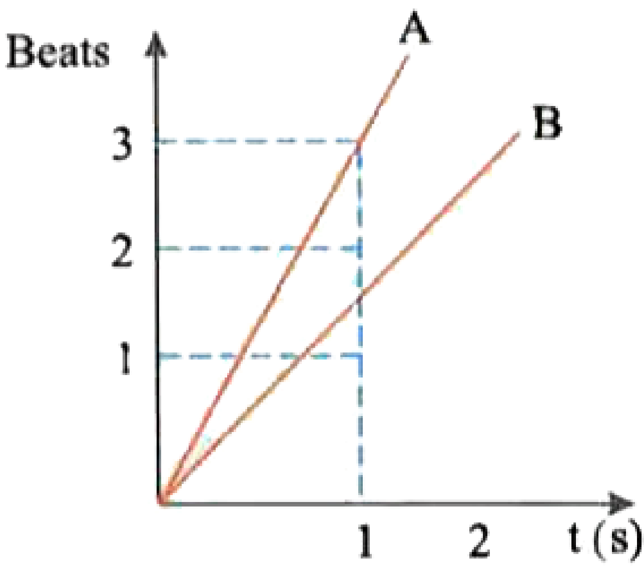
31. Two tuning forks P and Q are vibrated together . The number of beats produced are represented by the straight line OA in the following graph. After loading Q with wax again these are vibrated together and the beats produced are represented by the line OB. If the frequency of P is $341 Hz$, the frequency of Q will be ________



A. $341 Hz$

B. $338Hz$

C. $344Hz$

D. $330Hz$

Answer: C

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32. A driver in a stationary car blows a horn which produces monochromatic sound waves of freqeuncy 1000 Hz normally towards a reflecting wall. The wall approaches the car with a speed of $3.3\frac{m}{s}$.

A. the frequency of sound reflected from wall and heard by the driver is $1000 Hz$

B. the frequency of sound reflected from wall and heard by the driver is $980 Hz$

C. the percentage increase in frequency of sound after reflection from wall is 2%

D. the percentage decrease in frequency of sound after reflection from wall is 2%

Answer: C

Watch Video Solution

33. A source of sonic oscillations with frequency $n = 1700Hz$ and a receiver are located on the same normal to a wall. Both the source and receiver are stationary, and the wall recedes from the source with velocity $u = 6.0\frac{m}{s}$. Find the beat frequency registered by the receiver. The velocity of sound is $v = 340\frac{m}{s}$.

A. $0.2Hz$

B. $0.3Hz$

C. $0.4Hz$

D. $0.6Hz$

Answer: D

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

A. $49m$

B. $98m$

C. $147m$

D. $196m$

Answer: B

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35. A train moves towards a stationary observer with speed 34 m/s. The train sounds a whistle and its frequency registered by the observer is f_1. If the speed of train is reduced to 17 m/s, the frequency registered is f_2. If speed fo sound is 340 m/s, then the ratio f_1/f_2 is :

A. $\frac{18}{19}$

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

C. 2

D. $\frac{19}{18}$

Answer: D

Watch Video Solution

36. Two sound sources emitting sound each of wavelength λ are fixed at a given distance apart. A listener moves with a velocity u along the line joining the two suorces. The number of beats heard by him per second is

A. $\frac{2u}{\lambda}$

B. $\frac{u}{\lambda}$

C. $\sqrt{\frac{ambda}{}}$

D. $\frac{u}{2\lambda}$

Answer: A

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37. A source of sound is travelling with a velocity of $30\frac{m}{s}$ towards a stationary observer.

If actual frequency of source is 1000 Hz and the wind is blowing with velocity $20\frac{m}{s}$ in a direction at $60^{\circ}C$ with the direction of motion of source, then the apparent frequency heard by observer is (speed of sound is $340\frac{m}{s}$)

A. $1011Hz$

B. $1094Hz$

C. $1000Hz$

D. $1086Hz$

Answer: B

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38. A band playing music at a frequency f_0 is moving toweards a wall at a speed v_0. A motorist is following the band with a speed v_m. If v be the speed of the sound the expression for beat frequency heard by motorist is

A. $\dfrac{v + v_m}{v - v_b} f$

B. $\dfrac{v + v_m}{v + v_b} f$

C. $\dfrac{2v_b\left(v + v_m\right)}{v^2 - v_b^2}f$

D. $\dfrac{2v_m\left(v + v_b\right)}{v^2 - v_m^2}f$

Answer: C

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39. A train has just completed a U-curve in a trach which is a semi circle. The engine is at the forward end of the semi circular part of the trach while the last carriage is at the rear end of the semi circular track. The driver blows a whistle of frequency 200 Hz. Velocity of sound is $340\frac{m}{s}$. Then the apparent frequency as observed by a passenger in the middle of the train, when the speed of the train is 30 m/s, is

A. $219Hz$

B. $188Hz$

C. $200Hz$

D. $181Hz$

Answer: C

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

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

B. $\frac{2vf^2}{2vf + a}$

C. $\frac{2vf^2}{3vf - a}$

D. $\frac{2vf^2}{2vf - a}$

Answer: D

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41. The waves produced by a motor boat sailing in water are :

A. neighter longitudinal nor transverse

B. both longitudinal and transverse

C. only longitudinal

D. only transverse

Answer: B

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42. Sound waves of wavelength λ travelling in a medium with a speed of $\upsilon m/s$ enter into another medium where its speed is $2\upsilon m/s$.

Wavelength of sound waves iin the second medium is

A. λ

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

C. 2λ

D. 4λ

Answer: C

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43. Speed of sound waves in air

A. is independent of temperature

B. increases with pressure

C. increases with increase in humidity

D. decreases with increase in humidity

Answer: C

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44. Change in temperature of the medium changes

A. frequency of sound waves

B. amplitude of sound waves

C. wavelength of sound waves

D. loudness of sound waves

Answer: C

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45. With the propagation of a longitudinal wave through a material medium, the quantities transmitted in the propagation direction are

A. matter

B. energy

C. energy and matter

D. energy, matter and momentum

Answer: B

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46. Which of the following statements are true for wave motion? $Statement 1$ - Mechanical transverse waves can propagate through all media $Statement 2$ - Longitudinal waves can propagate through solids only $Statement 3$ - Mechanical transverse waves can propagate through solids only $Statement 4$ - Longitudinal waves can propagate through vacuum.

A. Mechanical transverse waves can propagate through all media

B. Longitudinal waves can propagate through solids only

C. Mechanical transverse waves can propagate through solids only

D. Longitudinal waves can propagate through vacuum.

Answer: C

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47. A sound wave is passing through air column in the form of compression and rerefactions. In consecutive compressions and rerefactions.

A. density remains constant

B. Boyle's law is obeyed

C. bulk modulus of air oscillates

D. there is no transfer of heat

Answer: D

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48. Equation of a plane progressive wave is given by $y = 0.6\sin 2\pi\left(t - \frac{x}{2}\right)$. On reflection from a denser medium, its amplitude becomes 2/3 of the amplitude of the incident wave. The equation of the reflected wave is

A. $y = 0.6\sin 2\pi\left(t + \frac{x}{2}\right)$

B. $y = -0.4\sin 2\pi\left(t + \frac{x}{2}\right)$

C. $y = 0.4\sin 2\pi\left(t + \frac{x}{2}\right)$

D. $y = -0.4\sin 2\pi\left(t - \frac{x}{2}\right)$

Answer: B

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49. A string of mass 2.50kg is under a tension os 200N. The length of the stretched string is 20.0m. If the transverse jerk is struck at one end of the string, how long does the disturbance take to reach the other end?

A. $1s$

B. $0.5s$

C. $2s$

D. data given is insufficient

Answer: B

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50. A transverse harmonic wave on a string is described by $y(x, t) = 3.0\sin\left(36t + 0.018x + \frac{\pi}{4}\right)$

where x and y are in cm and 't' is in sec. The positive direction of 'x' is from left to right

Which of the following are true

(a) the wave is travelling from right to left

(b) the speed of the wave is $20m/s$

(c) frequency of the wave is $5.7Hz$

(d) the least distance between two successive crests in the wave is $2.5cm$.

A. a, b

B. a, b, c

C. c, d

D. a, c, d

Answer: B

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51. The displacement of a string is given by $y(x, t) = 0.06\sin(2\pi x/3)\cos(120\pi t)$ where x and y are in m and t in s. The lengthe of the string is 1.5m and its mass is $3.0 \times 10^{-2} kg$.

A. It represents a progressive wave of frequency $60 Hz$

B. It represents a stationary wave of frequency $50 Hz$

C. It is the result of superposition of two waves of wavelength $3m$, frequency $60 Hz$ each travelling with a speed of $180 m/s$ in opposite direction

D. Amplitude of this wave is constant.

Answer: C

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52. v31

A. a, b

B. b, c

C. c, d

D. a, b, c

Answer: C

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53. During propagation of a plane progressive mechanical wave

Which of the following are true

(a) all the particles are vibrating in the same phase

(b) amplitude of all the particles is equal

(c) particles of the medium executes SHM

(d) wave velocity depends upon the nature of the medium

A. c, d

B. b, c, d

C. a, c, b

D. a, b, c, d

Answer: B

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54. The transverse displacement of a string (clamped at its both ends) is given by $y(x, t) = 0.06\sin(2\pi x/3)\cos(120\pi t)$.

All the points on the string between two consecutive nodes vibrate with

A. a, b

B. b, c

C. c, d

D. a, b, d

Answer: D

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55. A train, standing in a station yard, blows a whistle of frequency 400Hz in still air. The wind starts blowing in the direction from the yard to the station with a speed of 10m//s. Given that the speed sound in still air is `34om//s,

A. a, b are true

B. b, c are true

C. only c true

D. a, b, d are true

Answer: A

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56. Which of the following statement(s) is are true for a stationary wave. I) Every particle has a fixed amplitude which is different from the amplitude of its nearest particle. II) All the particles cross their mean positions at the same time. III) There is no net transfer of energy across any plane.

A. a, b, c

B. a, b, d, e

C. b, c, d, e

D. all

Answer: B

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