PHYSICS

BOOKS - DHANPAT RAI & CO PHYSICS (HINGLISH)

Waves

EXAMPLE

1. Discuss some of the important characteristics of wave motion.

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2. What are the different types of waves we come across ?Give examples of each type.

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3. On the basis of spring model, explain the propagation of a sound in air.

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4. What are transverse and longitudinal waves?Explain with suitable examples.

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5. Which properties of a medium are responsible for propagation of wave through it ?

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6. Through what type of media can transverse waves be transmitted? Give reason

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7. Through what type of media can longitudinal waves be transmitted? Give reason

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8. In reference to a wave motion ,define the term amplitude

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9. Define time period

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10. In reference to a wave motion ,define the term frequency

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11. In reference to a wave motion ,define the term angular frequency

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12. In reference to a wave motion, define the term wavelength

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13. Define wave length , frequency and wave number. How is frequency related to wave number ?

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14. In reference to a wave motion ,define the term angular wave number

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15. Briefly explain the terms wavelength, frequency, time period and velocity of wave motion. Establish relation between them.

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16. Derive an expression of wave velocity in terms of frequency and wavelength of the wave.

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17. How far does the sound travel in air when a tuning fork of frequency 256 Hz makes 64 vibrations ? Velocity of sound in air = $320ms^{-1}$

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18. A source of sound is placed at one end of an iron bar 2 km long. Two sounds are heard at the other end at an interval of 5.6s. If the velocity of sound in air is $330m/s$, find the velocity of sound in iron.

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19. Audible frequencies have a range 20 Hz to 20,000 Hz. Express this range in terms of (i) period T (ii) wavelength λ in air and (ii) angular frequency. Given velocity of sound in air is $330ms^{-1}$

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20. Audible frequencies have a range 20 Hz to 20,000 Hz. Express this range in terms of wavelength λ in air. Given velocity of sound in air is $330ms^{-1}$.

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22. On the basis of dimensional considerations, write the formula for the speed of transverse waves on a stretched string.

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23. On the basis of dimentional considerations,write the formula for the speed of transverse waves in a solid.

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24. For aluminium , the modulus of rigidity is $2.1 \times 10^{10} Nm^{-2}$ and density is $2.7 \times 10^3 kg / m^3$.Find the speed of transverse waves in the medium.

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25. A steel wire 0.72 m long has a mass of 5.0×10^{-3} kg . If the wire is under a tension of 60 N, what is the speed of transverse waves on the wire ?

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26. In a sonometer experiment, the density of material of the wire used in $7.5 \times 10^3 kg/m^3$. If the stress of the wire is $3.0 \times 10^8 N/m^2$, find out the speed of transverse waves in the wire.

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27. A copper wire is held at the two ends by rigid supports. At $30^\circ C$, the wire is just taut with negligible tension. Find the speed of transverse waves in the wire at $10^\circ C$. Given $\alpha = \left(1.7 \times 10^{-5}\right)^\circ C^{-1}$, $Y = 1.4 \times 10^{11} Nm^{-2}$ and $\rho = 9 \times 10^3 kgm^{-3}$.

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28. Write expression for the speed of a longitudinal wave in a liquid or gas.

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29. Write expression for the speed of a longitudinal wave in a solid.

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30. Write expression for the speed of a longitudinal wave in a long solid rod.

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31. Write Newton's formula for the speed in a gas.Why and what correction was applied by Laplace in this formula?

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32. For aluminium the bulk modulus and modulus of rigidity are $7.5 \times 10^{10} Nm^{-2}$. Find the velocity of longitudinal waves in the mediu. Density of aluminium is $2.7 \times 10^3 kgm^3$.

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33. For a steel rod, the Young's modulus of elasticity is $2.9 \times 10^{11} N/m^2$, and the density of steel is $8 \times 10^3 kg/m^3$.What is the velocity of longitudinal waves in steel?

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34. At a pressure of $10^5 N/m^2$, the volumetric strain of water is 5×10^{-5}. Calculate the speed of sound in water. Density of water is $10^3 kg/m^3$.

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35. Estimate the speed of sound in air at standard temperature and pressure. The mass of 1 mole of air is $29.0 \times 10^{-3} kg$, λ for air $= 7/5$.

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36. What is evaporation? State the various factors which affect evaporation.

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37. At what temperature will the speed of sound be double its value at 273K?

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

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39. A tuning fork of frequency 220Hz produces sound waves of wavelength 1.5m in air at NTP. Calculate the increase in wavelength, when temperature of air in $27^\circ C$.

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40. Find the temperature at which sound travels in hydrogen with the same velocity as in oxygen at $1000^\circ C$. Density of oxygen is 16 times that of hydrogen.

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

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42. At normal temperature and pressure, the speed of sound in air is 332 m/s. What will be the speed of sound in hydrogen at $546^{\circ}C$ and 2 atmospheric pressure ? Given air is 16 times heavier than hydrogen.

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43. 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 $\sqrt{\frac{21}{3}}$.

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44. The ratio of densities of oxygen and nitrogen is 16 : 14. At what temperature, the speed of sound in oxygen will be equal to its speed in nitrogen at $14^\circ C$?

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45. A gas is a mixture of two parts by volume of hyprogen and part by volume of nitrogen at STP. If the velocity of sound in hydrogen at $0^\circ C$ is $1300m/s$. Find the velocity of sound in the gaseous mixure at $27^\circ C$.

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46. PROGRESSIVE WAVES

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47. Obtain the equation of a plane progressive simple harmonic wave.

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48. The equation of a simple harmonic progressive wave along the positive direction of X axis is given by

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49. What do you mean by phase of a wave ?discuss the phase change with time and position.

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50. In a simple harmonic progressive wave, the maximum particle velocity is twice the wave velocity. If λ is the wavelength, then its amplitude is given by

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51. In a simple harmonic progressive wave, the maximum particle velocity is twice the wave velocity. If λ is the wavelength, then its amplitude is given by

A. icle acceleration.Discuss their phase relationship with displacement

B.

C.

D.

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52. Define wave velocity or phase velocity . Deduce its relation with angular frequency ω and propagation consant κ .

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53. The displacement y of a partcle in a medium can be expressed as, $y = 10^{-6}\sin\left(\left(100t + 20x + \frac{\pi}{4}\right)m\right.$ where t is in second and x in meter. The speed of the wave is

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54. A harmonically moving transverse wave on a string has a maximum particle velocity and acceleration of 3 m/s and $90m/s^2$ respectively. Velocity of the wave is $20m/s$. Find the waveform.

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55. A wave travelling along a strong is described by

$$y(x,t) = 0.005\sin(80.0x - 3.0t)$$

in which the numerical constants are in SI units $(0.005m, 80.0 rad m^{-1}$ and $3.0 rad s^{-1})$. Calculate (a) the amplitude. (b) the wavelength (c) the period and frequency of the wave. Also , calculate the displacement y of the wave at a distance $x = 30.0$ cm and time t=20 s?

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60. The equation of a plane progressive wave is give by equation

$y = 10 \sin 2\pi(t - 0.005x)$

where y and x are in cm and t is in seconds. Calculate the amplitude, frequency, wavelength and velocity of the wave.

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61. The equation of a plane progressive wave is $y = 5\sin 2\pi(x - 2t)$. Where y and x are in an and t in seconds. Calculate the velocity of the wave.

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62. The equation of a plane progressive wave is $y = 10\sin 2\pi(t - 0.05x)$. Where y and x are in an and t in seconds. Calculate the amplitude, frequency, wavelength and velocity of the wave.

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63. The equation of a plane progressive wave is give by equation

$y = 10\sin 2\pi(t - 0.005x)$

where y and x are in cm and t is in seconds. Calculate the amplitude, frequency, wavelength and velocity of the wave.

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64. A wave travelling along a string is given by $y(x, t) = 0.05\sin(40x - 5t)$, in which numerical constants are in SI units. Calculate the displacement at distance 35 cm from origin, and time 10 sec.

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65. A wave travelling along a string is described by $Y(x, t) = 0.005\sin(80x - 3t)$ in which the numerical constants are in SI units. Calculate (i) amplitude

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66. A wave travelling along a strong is described by

$y(x, t) = 0.005 \sin(80.0x - 3.0t)$

in which the numerical constants are in SI units $(0.005m, 80.0radm^{-1}$ and $3.0rads^{-1})$. Calculate (a) the amplitude. (b) the wavelength (c) the period and frequency of the wave. Also , calculate the displacement y of the wave at a distance $x = 30.0$ cm and time t=20 s?

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67. A wave travelling along a string is described by $Y(x, t) = 0.005 \sin(80x - 3t)$ in which the numerical constants are in SI units. Calculate wavelength

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68. A displacement wave is represented by

$\xi = 0.25 \times 10^{-3} \sin(500t - 0.025x)$

Deduce (i) amplitude (ii) period (iii) angular frequency (iv)wavelength (v) amplitude of particle velocity (vi) amplitude of particle acceleration . ξ, t and x are in cm, sec, and metre respectively.

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69. A displacement wave is represented by

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71. A progressive wave is represented by the equation $y = 0.5 \sin(314t - 12.56x)$ where y and x are in metre and t is in second .Its wavelength is

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72. A displacement wave is represented by

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74. The speed of a wave in a streched string is $20ms^{-1}$ and its frequency is 50 Hz. Calculate the phase difference in radian between two points situated at a distance of 10 cm on the string.

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75. Write the equation of a progressive wave propagating along the positive x-direction, whose amplitude is 5cm, frequency 250Hz and velocity 500 m / s.

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76. For a stationary wave

$y = 10 \sin\left(\frac{\pi x}{15}\right) \cos(48\pi t)$ cm, the distance between a node and the nearest antinode is

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78. The equation of a progressive wave is $y = 0.4 \sin 2\pi \left[\frac{t}{0.02} - \frac{x}{60} \right]$, where x is in cm. Thenn the phase difference between two points separated by 6 cm at any instant is

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79. For the plane wave $y = 2.5 \times 10^{0.02x} \cos\left(800t - 0.82x + \frac{\pi}{2}\right)$, write down the change in phase at a given place 0.6 milli second. Take units of y, t, x as $10^{-5} cm$, s and m respectively.

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80. For the plane wave $y = 2.5 \times 10^{0.02x} \cos\left(800t - 0.82x + \frac{\pi}{2}\right)$, write down the amplitude at x = 100 m . Take units of y, t, x as $10^{-5} cm$, s and m respectively.

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81. A simple harmonic wave train of amplitude 1 cm and frequency 100 vibration is travelling along positive x-direction with a velocity of $15ms^{-1}$. Calculate displacement y , the particle velocity and particle acceleration at $x = 180cm$ from the origin at $t = 5$ s.

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82. A certain spring has a linear mass density of $0.25kgm^{-1}$ and is stretched with a tension of 25 N. One end is given a sinusoidal motion with frequnecy 5 Hz and amplitude 0.01 m. At time t=0, the other end has zero displacement and is moving in the positive y-direction.

(i) Find the wave speed, amplitude, angular frequnecy, period, wavelength and wave number.

(ii) Write a wave function representing the wave.

(iii) Find the position of the point at x=0.25m at time t=0.1s.

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(ii) Write a wave function representing the wave.

(iii) Find the position of the point at x=0.25m at time t=0.1s.

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90. A wave is reflected from a rigid support. The change in phase on reflection will be

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91. What type of waves are illustrated by the movement of a rope whose one end is fixed to a pole and the other end is moved up and down?

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92. Considering the wave pulses travelling on stretched strings, discuss the phase change during the refraction of a wave.

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93. State the principle of superposition of waves.

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94. What are stationary waves?

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95. What is the necessary condition for the formation of stationary waves ?

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96. In a stationary wave,

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97. Explain the formation of stationary waves by analytical method. Shwo that nodes and antinodes are equally spaced in sationary waves.

The radius gyration of a body about an axis, at a distance of 0.4 m from its centre of mass is $0.5m$. Find its radius of gyrtion about a parallel axis passing through its centre of mass.

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98. In a stationary wave that forms as a result of reflection of waves from an obstacle, the ratio of the amplitude at an antinode to the amplitude at node is 6. What percentage of energy is transmitted?

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99. Give some important characteristics of standing waves.

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100. Give two difference between progressive wave and stationary wave.

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101. The constituent waves of a staionary wave have amplitude, frequency and velocity as 8 cm, 30 Hz and $180cms^{-1}$ respectively. Write down the equation of the stationary wave.

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102. Stationary waves are set up by the superposition of two waves given by

$y_1 = 0.05 \sin(5\pi t - x)$ and $y_2 = 0.05 \sin(5\pi t + x)$

where x and y are in metres and t is second. Find the displacement of a particle situated at a distance x=1m.

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103. Give a qualitative discussion of the modes of vibrations of a stretched string fixed at both the ends.

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104. Give analytical treatment of formation of standing waves on strings and discuss briefly the normal modes of vibration of strings.

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105. State and explain the laws of vibrations of stretched strings.

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106. 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

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107. Calculate the fundamental frequency of a sonometer wire fo length 20cm, tension 25N, cross sectional area $10^{-2} cm^2$ and density of material $= 10^4 kg/m^3$.

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108. The length of a sonometer wire is $0.75m$, and density $9 \times 10^3 m$. It can bear a stress of $8.1 \times 10^8 N/m^2$ without exceeding the elastice limit. What is the fundamental frequency that can be produced in the wire?

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109. A stretched wire emits a fundamental note of2 56 Hz. Keeping the stretching force constant and reducing the length of wire by 10 cm, the frequency becomes 320 Hz, the original length of the wire is

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110. Find the fundamental note emitted by a string of length $10\sqrt{10}$ cm under tension of 3.14 kg. Radius of string is 0.55 mm and density $= 9.8 gcm^{-3}$.

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111. A rope 5 m long has a total mass of 245g. It is stretched with a constant tension of 1 kg wt. If it is fixed at one end and shaken by hand at the other end, what frequency of shaking will make it break up into three vibrating segments? Take $g = 980cms^{-2}$.

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112. In a experiment it was found that the string vibrated in three loops when 8 g were placed on the scale pan. What must be placed on the pan to make the string vibrate in six loops? Neglect the mass of the string and the scale pan.

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113. A wire of length 108 cm produces a fundamental note of frequency 256 Hz, when stretched by a weight of 1 kg. By how much its length should be increased so that its pitch is raised by a major tone, if it is now stretched by a weight of 4 kg?

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114. The length of a wire between the two ends of a sonometer is 105 cm. Where should the two bridges be placed so that the fundamental frequencies of the three segments are in the ratio of 1:3:15?

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115. The fundamental frequency of a sonometer wire increases by 5Hz , if it's tension is increased by 21% . How will the frequency be affected, if its length is increased by 10% ?

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116. A stone hangs in air from one end of a wire, which is stretched over a sonometer. The wire is in unison with a certain tuning fork when the bridges of sonometer are 45 cm apart. Now the stone hangs immersed in water at $4^{\circ}C$ and the distance between the bridges has to be altered by 9cm to re-establish unison of the wire with the same fork. Calculate the density of the stone.

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117. A wire having a linear mass density 5.0×10^{-3} kg/m is stretched between two rigid supports with a tension of 450 N. The wire resonates at a frequency of 420 Hz. The next higher frequency at which the same wire resonates is 480 Hz. Find the length of the wire.

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118. Describe the various modes of vibrations of an open organ pipe.

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119. For an open organ pipe of length l the wavelength of the fundamental note is equal to-

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120. At the closed end of an organ pipe :

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121. Prove analytically that in the case of a closed organ pipe of length l, the frequencies of the vibrating air column are given by $\nu=(2n+1)(v/4L)$, where n is an integer.

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122. What should be minimum length of an open organ pipe for producing a note of 110 Hz. The speed of sound is $330ms^{-1}$.

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123. The length of an organ pipe open at both ends is 0.5m in Calculate the fundamental frequency of the pipe, if the velocity of sound in air be $350ms^{-1}$?

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124. A pipe 30.0 cm long is open at both ends. Which harmonic mode of the pipe resonates with a 1.1kHz source? Will resonance with the same source be observed if one end of the pipe is closed ? Take the speed of sound in air as $330ms^{-1}$.

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125. Find the ratio of the length of a closed pipe to that of an open pipe in order that the second overtone of the former is in unison with fourth overtone of the latter.

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126. 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 $100Hz$ then the fundamental frequency of the open pipe. The fundamental frequency of the open pipe is

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127. The first overtone of an open orgen pipe beats with the first ouertone of a closed orgen pipe with a beat frequency of $2.2H_Z$. The fundamental frequency of the closed organ pipe is $110H_Z$. Find the lengths of the pipes . Speed of sound in air $u = 330m/s$.

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128. A well with vertical sides and water at the bottom resonates at 7Hz and at no other lower frequency. The air in the well has density $1.10kgm^{-3}$ and bulk modulus of water is $1.33 \times 10^5 N/m^2$. How deep is the well ?

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129. A resonance air column resonates with a tuning fork of 512 Hz at length 17.4 cm. Neglecting the end correction, deduce the speed of sound in air.

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130. A resonance tube is resonated with tuning fork of frequency 512 Hz. Two successive lengths of the resonated air column are 16.0 cm and 51.0cm. The experiment is performed at room temperature of $40^\circ C$. Calculate speed of sound at $0^\circ C$ and end correction.

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131. Determine the possible harmonics in the longitudinal vibrations of a rod clampred in the middle.

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132. A brass rod 1 metre long is firmly clampled in the middle and one end is stroked by a resined cloth. What is the pitch of the note you will hear ? Density of brass $= 9gcm^{-3}$ and Young's modulus of brass $= 10^{12} \text{dyne} / cm^2$.

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133. What is the essential condition for the formation of beats?

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134. Describe the formation of beats.

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135. Attempt any THREE :

Show that beats frequency is equal to frequency difference between two interfering waves.

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136. name any one use of the phenomenon of beats.

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137. Explain some practical applications of beats.

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138. The points of the prongs of a tuning fork B originally in unison with a tuning fork A of frequency 384 are filed and the fork produces 3 beats per second, when sounded together with A. What is the pitch of B after filing ?

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139. A tuning fork arrangement (pair) produces $4 beats / \sec$ with one fork of frequency $288 cps$. A little wax is placed on the unknown fork and it then produces $2 beats / \sec$. The frequency of the unknown fork is

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140. 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.

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141. A fork of unknown frequency when sounded with one of frequency 288 Hz gives 4 beats per second and when loaded with a piece of wax again gives 4 beats per second. How do you account for this and what was the unknown frequency ?

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142. Two tuning forks A and B produce 4 beats $/$sec. On loading B with wax, 6 beats $/$ sec are heard. If quantity of wax is reduced, the number of beats per second again becomes 4.Find the frequency of B if the frequency of A is 256 Hz.

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143. A tunning fork produces 6 beast/s when sounded with a tuning fork of frequnecy 256 Hz. The same tunning fork when sounded with another tunning fork of frequency 252 Hz produces 2 beat/s. Find the frequency of the tunning fork.

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144. A tuning fork of known frequency $256Hz$ makes 5 beats per second with the vibrating string of a piano. The beat frequency decreases to 2 beats per second when the tension in the piano string is slightly increased. The frequency of the piano string before increasing the tension was

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145. When two tuning forks (fork 1 and fork 2) are sounded simultaneously, 4 beats per second are heard. Now some tape is attached on the prong of the fork 2. When the tuning fork are sounded again, 6 beats per second are heard. If the frequency of fork 1 is $200Hz$, then what was the original frequency of fork 2 ?

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146. A set of 24 tuning fork is arranged in a series of increasing frequencies. If each fork gives 4 beats per second with the preceding one and the last sounds the ocatve of the first, find the frequencies of the first and the last forks.

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147. In an experiment, it was found that a tuning fork and sonometer wire gave 5 beats per second, both when the length of wire was 1m and 1.05m. Calculate the frequency of the fork.

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148. A tuning fork of frequency 200Hz is in unison with a sonometer wire. How many beats $/$sec will be heard if tension in the wire is increased by 2% ?

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149. A knife edge divides a sonometer wire in two parts which differ in length by 2mm. The length of the wire is 1m. The two parts of the string when sounded together produce on beat per second, then the frequency of the smaller and the longer parts of the wire in Hz will be

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150. Two similar sonometer wires of the same same material produce 2 beats per second. The length of one is 50 cm and that of the other is 50.1 cm. Calculate the frequencies of the two wires.

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151. A tuning fork of unknown frequency vibrates in unison with a wire of certain stretched under a tension of 5 kg f. It produces 6 beats per second with the same wire, when tension is changed to 4.5 kg f. Find the frequency of tuning fork.

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152. Calculate the velocity of sound in a gas in which two sound waves of length 100cm, and 101 cm. produced 24 beats in 6 seconds.

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153. Two air columns of resonance appatus, 100cm and 101 cm long give 17 beats in 20 second, when each is sounding its fundamental mode. Calculate the velocity of sound.

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154. Two tuning fork A and B give 5 beats $/$ sec. A resounds with a closed column of air 15 cm long and B with an open column of air 30.5 cm long. Calculate their frequecies. Neglect end correction.

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155. At $16^{\circ} C$, two open organ pipes , when sounded together, produce 34 beats in 2 seconds. How many beats per second will be produced, if the temperature rises to $51^\circ C$? Neglect the increase in the length of the pipes.

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156. A column of air and a tuning fork produce 4 beats per second when sounded together. The tuning fork gives the lower note. The temperature of air is $15^\circ C$. When the temperature falls to $10^\circ C$, the two produce 3 beats per second. Find the frequency of the fork.

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157. DOPPLER EFFECT

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158. Doppler effect in sound is asymmetric. What do you mean by this statement ?

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159. A source and an observer are approaching one another with the relative velocity $40ms^{-1}$. If the true source frequency is 1200 Hz, deduce the observed frequency under the following conditions:

(i) All velocity is in the source alone.

(ii) All velocity is in the observer alone.

The source moves in air at $100ms^{-1}$ towards the observer, but the observer also moves with the velocity v_0 in the same direction.

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160. A source and an observer are approaching one another with the relative velocity $40ms^{-1}$. If the true source frequency is 1200 Hz, deduce the observed frequency under the following conditions:

(i) All velocity is in the source alone.

(ii) All velocity is in the observer alone.

The source moves in air at $100ms^{-1}$ towards the observer, but the observer also moves with the velocity v_0 in the same direction.

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161. A source and an observer are approaching one another with the relative velocity $40ms^{-1}$. If the true source frequency is 1200 Hz, deduce the observed frequency under the following conditions:

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(ii) All velocity is in the observer alone.

The source moves in air at $100ms^{-1}$ towards the observer, but the observer also moves with the velocity v_0 in the same direction.

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162. A railway engine and a car are moving on parallel tracks in opposite directinos with speeds of $144 km / hr$ and $72 km / h$ respectively. The engine is continously sounding a whistle of frequency 500Hz. The velocity of sound in $340 ms^{-1}$. Calculate the frequency of sound heard in the car when

(i) the car and engineare approaching one another,

(ii) the two are moving away from one another.

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163. A railway engine and a car are moving on parallel tracks in opposite directinos with speeds of $144 km / hr$ and $72 km / h$ respectively. The engine is continously sounding a whistle of frequency 500Hz. The velocity of sound in $340 ms^{-1}$. Calculate the frequency of sound heard in the car when

(i) the car and engineare approaching one another,

(ii) the two are moving away from one another.

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164. The sirens of two fire engines have a frequency of 600 Hz each . A man hears the sirens from two engines, one approaching him with a velocity of $36km/h$ and the other going away from him at a speed of $54km/h$. What is the difference in frequencies of sound heard ? Take velocity of sound in air $= 340m/s$.

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165. 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?

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166. An observer standing on a railway crossing receives frequencies 2.2 kHz and 1.8 kHz when the tran approaches and recedes from the observer. Find the velocity of the train (speed of sound in air is 300 m/s).

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167. On a quiet day, two persons A and B, each sounding a note of frequency 580 Hz, are standing a few metres apart. Calculate the number of beats heard by each in one second when A moves towards B with a velocity of $4ms^{-1}$. (Speed of sound in air $= 330ms^{-1}$.)

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168. Find the velocity of source of sound, when the frequency appears to be (i) double (ii) half the original frequency to a stationary observer. Velocity of sound $= 330ms^{-1}$.

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169. Find the velocity of source of sound, when the frequency appears to be (i) double (ii) half the original frequency to a stationary observer. Velocity of sound $= 330 ms^{-1}$.

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170. A train stands at a platform blowing a whistle of frequency 400Hz in still air. What is the frequency of the whistle heard by a man running (a) towards the engine at $10 ms^{-1}$ (b) away from the engine at $10 m/s$?

What is the wavelength of sound received by the running man in each case ?

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171. Consider a source moving towards an observer at the speed of $v_s = 0.95v$. Deduce the observed frequency if original frequency is 500Hz. What would happen if $v_s > v$? (Jet planes moving faster than sound are common). Here , v is velocity of sound in air.

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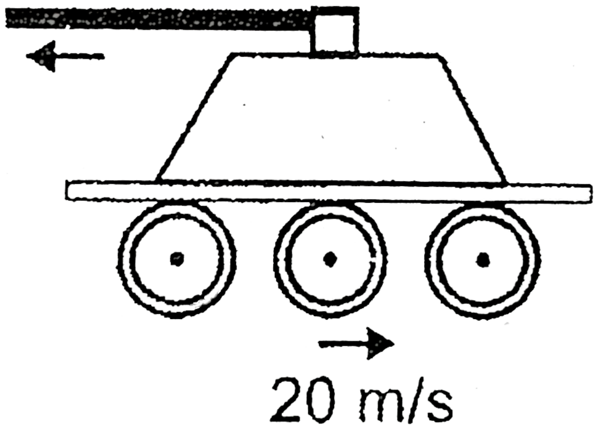
172. A machine gun is mounted on an armored car moving with a speed of $20ms^{-1}$. The gun point against the direction of motion of car. The muzzle speed of bullet is equal to speed of sound in air i.e., $340ms^{-1}$. The time difference between bullet actually reaching and sound of firing reaching at a target $544m$ away from car at the instant of firing is reaching at a target $544m$ away from car at the

instant of firing is



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173. An observer is moving towards a wall at $2ms^{-1}$. He hears a sound from source at some distance behind him directly as well as after reflection from the wall. Calculate the beat frequency between these two sound, if the true frequency of the source is 680 Hz. Velocity of sound $-340m/s$.

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174. A rocket is moving at a speed of $200ms^{-1}$ towards a stationary target. While moving, it emits a wave of frequency 1000 Hz. Some of the sound reaching the target gets reflected back to the racket as an echo. Calculate the frequency of sound as detected by the person at the position of target and frequency of echo as detected by the rocket . Given velocity of sound $= 330ms^{-1}$.

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175. A rocket is moving at a speed of $200ms^{-1}$ towards a stationary target. While moving, it emits a wave of frequency 1000 Hz. Some of the sound reaching the target gets reflected back to the racket as an echo. Calculate the frequency of sound as detected by the person at the position of target and frequency of echo as detected by the rocket . Given velocity of sound $= 330ms^{-1}$.

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176. A siren is fitted on as car going towards a vertical wall at a speed of 36 km/h. A person standing on the ground, behind the car, listens to the siren sound coming directly from the source as well as that coming after refelction from the siren to the person and b. coming after reflection. Take the speed of sound to be $340ms^{-1}$

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177. A siren is fitted on as car going towards a vertical wall at a speed of 36 km/h. A person standing on the ground, behind the car, listens to the siren sound coming directly from the source as well as that coming after refelction from the siren to the person and b. coming after reflection. Take the speed of sound to be $340ms^{-1}$

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178. If the pitch of the sound of a source appears to drop by 10% to a moving person, then determine the velocity of motion of the person. Velocity of the sound $= 330ms^{-1}$.

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179. Two aeroplanes A and B are approaching each other and their velocities are $108kmh^{-1}$ and $144kmh^{-1}$ respectively. The frequency of a note emitted by A as heard by the passangers in B is 1170 Hz. Calculate the frequency of the note heard by the passangers in A. Velocity of sound $= 350ms^{-1}$.

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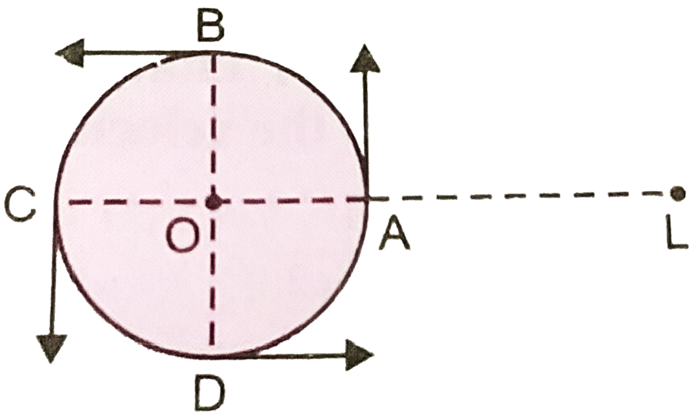
180. A whistle of frequency of 540Hz rotates ini a circle of radius 2m at an angular speed of 15rad / s. What is the lowest and highest frequency heard by a listener a long distance away at rest w.r.t centre of the circle. Can the apparent frequency be ever equal to the actuall frequency ? Take $v = 330 m / s$



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181. Distinguish between music and noise.

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182. Explain the characteristics of musical sounds. On what factors do they depend ?

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183. (a) What is the threshold of hearing ?

(b) What is the threshold of pain in the ear ?

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184. (a) What is the relation between loudness and frequency ?

(b) What is the unit of intensity of sound ?

(c) Derive the relation $v = v\lambda$ where the letters have their usual meanings.

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185. What do you mean by reverberation and reverberation time ? How is reverberation controlled ?

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186. What do you mean by reverberation and reverberation time ? How is reverberation controlled ?

Watch Video Solution

187. Is an oscillation a wave? Explain.

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188. A wave transmits linear momentum. Can it transfer angular momentum?

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189. Which is most fundamental property of a wave?

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190. Which of the following is not characteristic of waves : Reflection, refraction, interference, diffraction, polarisation, rectilinear propagation ?

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191. How is energy transmitted in wave motion ?

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192. Which properties of a medium are responsible for propagation of wave through it ?

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193. What is the source of electromagnetic waves?

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194. Why are longitudinal waves called pressure waves?

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195. What is a non dispersive medium?

Watch Video Solution

196. Can transverse waves be produced in air ?

Watch Video Solution

197. Do displacement, particle velocity and pressure variation in a longitudinal wave vary with the same phase?

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198. Distinguish between transverse and longitudinal wave motion.

Watch Video Solution

199. Transverse waves can propagate in

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200. What is the direction of oscillations of the particle of the medium through which a longitudinal wave is propagating ?

Watch Video Solution

201. What is the difference between wave velocity and particle velocity ?

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202. Why do we see lighting before we hear the thunder ?

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203. What does cause the rolling sound of thunder ?

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204. Two astronauts go the surface of the moon and would speak to each other. Explain how they could achieve this.

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205. A big explosion on the moon cannot be heard on the earth because

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206. When a stone is thrown on the surface of water, a wave travels out. From where does the energy come ?

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207. Why does sound travel faster in solids than in gases?

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208. How is it possible to detect the approaching of a distant train by placing the ear very close to the railway line ?

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209. If a person places his ear to one end of a long iron pipeline, he can distinctly hear two sounds when a workman hammers the other end of the pipeline. How ?

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210. Ocean waves hitting a beach are always found to be nearly normal to the shore.

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211. In which medium do the sound waves travel faster, solids, liquids or gases ? Why ?

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212. Sound travels faster on a rainy day than on a dry day. Why?

Watch Video Solution

213. At a constant temperature, pressure of a gas is made 4 times. How is velocity of sound in the medium affected ?

Watch Video Solution

214. Sound travels faster on a rainy day than on a dry day. Why?

Watch Video Solution

215. The changes in pressure an volume of air, when sound wave passes through air are

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216. Which characteristic of the medium determines the velocity of sound waves?

Watch Video Solution

217. If you set your watch by the sound of a distant siren, will it go fast or slow ?

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218. What will be the speed of sound in a perfectly rigid rod?

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219. Sound is produced at a time in two exactly identical strings, one of rubber and other of steel. In which string will the sound reach the other end earlier and why?

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220. The speed of sound does not depend upon its frequency. Give an example in support of this statement.

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221. Sound travels faster on a rainy day than on a dry day. Does it imply that speed of sound in moist hydrogen is greater than in dry hydrogen ?

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222. Velocity of sound in a tube containing air at 27°C and at a pressure of 76 cm of Hg is 300 m/s. What will its velocity be when the pressure is increased to 100 cm of Hg and the temperature is keptconstant ?

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223. Explain why (or how) : (a) In a sound wave, a displacement node is a pressure antinode and vice-versa,

(b) Bats can ascertain distances, directions, nature and size of obstacles without any eyes,

(c) a violin note and sitar note may have the same frequency, yet we can distinguish between the two notes, (d) Solids can support both longitudinal and transverse waves, but only longitudinal waves can propagate in gases,

(e) The shape of pulse gets distorted during propagation in a dispersive medium.

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224. An explosion takes place at the bottom of a lake. Will the shock waves in the water be longitudinal or transverse?

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225. Does the sound of a bomb explosion travel faster than the sound produced by a human bee ?

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226. A balloon is filled with CO_2. How will it behave as a lens for sound waves? What happens if CO_2 is replaced by hydrogen?

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227. Sound travels faster on a rainy day than on a dry day. Why?

Watch Video Solution

228. Why sound can be hear more distinctly at a greater distance over water surface ?

Watch Video Solution

229. What is a periodic wave function?

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230. What is a harmonic wave function ?

Watch Video Solution

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

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232. Sometimes, in a stringed instrument, a thick wire is wrapped by a thin wire. Why ?

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233. Why are the stationary wave called so?

Watch Video Solution

234. When are stationary waves produced?

Watch Video Solution

235. Under what condition does a sudden phase reversal of waves occur on reflection?

Watch Video Solution

236. A light wave is reflected from a mirror. The incident and reflected waves superimpose to form stationary waves. But no nodes and antinodes are seen. Why?

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237. What is the difference between a tone and a note?

Watch Video Solution

238. Why is note produces by an open organ pipe sweeter that that produced by a closed organ pipe of same length?

Watch Video Solution

239. Why are there so many holes in a flute?

Watch Video Solution

240. Why does the pitch of a note produced by a wooden open end pipe becomes sharper when the temperature rises ?

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241. When we start filling an empty bucket with water, the pitch of sound produced goes on changing. Why?

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

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243. A vibrating string is heated to a higher temperature. What happens to the pitch of the note produced by it ?

Watch Video Solution

244. Why are strings of different thicknesses and different materials used in a sitar or violin?

Watch Video Solution

245. A tuning fork is in resonance with a closed pipe. But the same tuning fork cannot be in resonance with an open pipe of same length. Why ?

Watch Video Solution

246. Why does the pitch of a note produced by a wooden open end organ pipe become shaper when the temperature increases ? Explain in detail.

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247. Two organ pipes of same length, open at both ends produce sound of different pitch, if their radii are different. Why?

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248. How does the frequency of a tunning fork change, when the temperature is increased?

Watch Video Solution

249. How does the frequency of a vibrating wire change when the attached load is immersed in water.

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250. What points of the stretched string between the fixed points must be plucked and touched to excite its second harmonic ?

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251. Why is a sonometer box provided with holes?

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252. The beats are not heard, if the difference in frequencies of the two sounding notes is more than 10. Why ?

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253. Assertion : Beats can also be observed by two light sourcesas in sound.

Reason : Light sources have constant phase deference.

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254. Is it necessary for production of beats that the two waves must have exactly equal amplitudes?

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255. If two sound waves of frequiencies $500Hz$ and $550Hz$ superimose , will they produce beats ? Would you hear the beats ?

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256. Can we hear beats when sounds of nearly equal frequencies from two different sources are heard together?

Watch Video Solution

257. Is Doppler effect applicable only to sound waves.

Watch Video Solution

258. What physical change occurs when a source of sound moves and listener is at rest?

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259. What physical change occurs when source of sound waves is at rest and the listener moves?

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260. Will there be Doppler effect, when the direction of motion of the source or observer is perpendicular to the direction of propagation of sound ?

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261. A person riding on a merry go round emits a sound wave of a certain frequency Does a person at the centre observe the Doppler effect?

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262. Will there be any Doppler shift when source and listener move in the same direction with the same velocity ?

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263. What is the time interval between the incident sound and the reflected sound for hearing a distinct echo ?

Watch Video Solution

264. Why cannot we hear an echo in a small room ?

Watch Video Solution

265. What do you mean by reverberation and reverberation time ? How is reverberation controlled ?

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266. What is meant by reverberation time?

Watch Video Solution

267. What is the difference between an echo and a reverberation ?

Watch Video Solution

268. The reverberation time is larger for an empty hall than for a crowded hall. Why ?

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269. Thick and long curtains arc preferred in a big hall. Why?

Watch Video Solution

270. An organ pipe emits a fundamental note of frequency 128 Hz. On blowing into it more strongly it produces the first overtone of frequency 384 Hz. What is the type of pipe - closed or open ?

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271. What is the range of frequencies of audio waves, infrasonics and ultrasonics ?

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272. How do we identify our friend from his voice while sitting in a dark room ?

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273. What determines the loudness of sound ?

Watch Video Solution

274. A violin and a sitar may have the same frequency, yet we can distinguish between their notes. Why ?

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275. The loudness and the pitch of a sound depends on

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276. Statement-1 : In the case of a stationary wave, a person hear a loud sound at the nodes as compared to the antinodes

Statement-2 : In a stationary wave all the particles of the medium vibrate in phase.

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277. Given below are some examples of wave motion. State in each case, if the wave motion is transverse, longitudinal or a combination of both?

(i) Motion of a kink in a long coil spring produced by displacing one end of spring side ways.

(ii) Waves produed in a cylinder containing a liquid by moving its piston back and forth.

(iii) Waves produed by a motor boat sailing in water.

(iv) Light waves travelling from sun to earth.

(v) ultrasonic waves in air produced by a vibrating quartz crystal.

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(iv) Light waves travelling from sun to earth.

(v) ultrasonic waves in air produced by a vibrating quartz crystal.

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282. The sound produced by a siren given by a company reaches a person on the road at a distance of 110 m in ______ s. (Velocity of sound in air is $330ms^{-1}$)

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283. If two wave of the same frequency differ in amplitude and are propagated in opposite directions through a medium , will they produce standing waves ? Is energy transported ? Are there any nodes ?

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284. What are overtones and harmonics ? The presence of which makes a sound musical ?

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285. Distinguish between harmonics and overtones.

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286. All harmonics are overtones but all overtones are not harmonics . Explain .

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287. The fundamental frequency of a source of sound is 200 Hz and the source produces all the harmonics. State, with reasons, with which of the following frequencies this source will resonate : 150, 200, 300 and 600 Hz ?

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288. An organ pipe is in resonance with a tuning fork. What change will have to be made in the length l to maintain resonance if

(i) temperature increases

(ii) air is replaced by hydrogen

(iii) pressure is made higher ?

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(i) temperature increases

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291. Two progressive sound waves each of frequency 170Hz and travelling in opposite directions in air superpose to produce stationary waves.

The speed of sound in air is 340 m / s. What is the

(i) separation between two successive nodes?

(ii) separation between two successive antinodes?

(iii) separation between a node and nearest antinode?

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(ii) separation between two successive antinodes?

(iii) separation between a node and nearest antinode?

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294. A sonometer wire resonates with a tuning fork. If the length of the wire between the bridges is made twice even then it can resonate with the same tuning fork. How ?

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295. Why does a tuning fork have two prongs ? Would the tuning fork be of any use, if one of the prongs is cut off ?

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296. Which factors determine the frequency of a tuning fork ?

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297. A sitar wire and a tabla, when sounded together, produce 5 beats per second. What does it indicate ? If the tabla membrane is tightened, will the beat rate increase or decrease ?

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298. Doppler's effect in light is symmetrical but the same effect in sound is asymmetrical. Explain.

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299. Distinguish between transverse and longitudinal waves.

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300. What is red shift ? What does it indicate ?

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301. An incident wave is represented by $y(x, t) = 20\sin(2x - 4t)$. Write the expression for reflected wave (i) from a rigid boundary (ii) from an open boundary.

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302. An incident wave is represented by $y(x, t) = 20 \sin(2x - 4t)$.

Write the expression for reflected wave (i) from a rigid boundary (ii) from an open boundary.

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303. State the principle of superposition of waves.

Watch Video Solution

304. Distinguish between conditions for the production of stationary waves and beats.

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305. Differentiate between Stationary waves and Progressive waves.

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306. Length of a string tied to two rigid support is $40cm$. Maximum length (wavelength in cm) of a stationary wave produced on it is

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307. Tube A has both ends open while tube B has one closed, otherwise they are identical. The ratio of fundamental frequency of tube A and B is

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308. An open pipe is in resonance in $2nd$ harmonic with frequency f_1. Now one end of the tube is closed and frequency is increased to f_2 such that the resonance again ocuurs in nth harmonic. Choose the correct option

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309. 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

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

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311. Two monoatomic ideal gases 1 and 2 of molecular masses m^1 and m^2 respectively are enclosed in separate containers kept at the same temperature. The ratio of the speed of sound in gas 1 to that in gas 2 is given by :-

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312. 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 strings vibrate in their fundamental modes, the one of length L with frequency n_1 and the other with frequency n_2 the ratio n_1 / n_2 is given by

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313. The ends of a stretched wire of length L are fixed at $x = 0$ and $x = L$. In one experiment, the displacement of the wire is

$y_1 = A\sin(\pi / L)\sin\omega t$ and energy is E_1 and in another experiment its displacement is $y_2 = A\sin(2\pi x / L)\sin 2\omega t$ and energy is E_2. Then

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314. A sonometer wire resonates with a given tuning fork forming a standing wave with five antinodes between the two bridges when a mass of $9kg$ is suspended from the wire. When this mass is replaced by a mass 'M' kg, the wire resonates with the same tuning fork forming three antinodes for the same positions of the bridges. Find the value of M.

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315. In the experiment for the determination of the speed of sound in air using the resonance column method, the length of the air column that resonates in the fundamental mode, with a tuning fork is $0.1m$.

When this length is changed to $0.35m$, the same tuning fork resonates with the first overtone. Calculate the end correction.

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316. A train moves towards a stationary observer with speed $34m/s$. The train sounds a whistle and its frequency registered by the observer is f_1. If the train's speed is reduced to $17m/s$, the frequency registered is f_2. If the speed of sound of $340m/s$, then the ratio $f_1/f_2$is

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317. A siren placed at a railway platform is emitting sound of frequency $5kHz$. A passenger sitting in a moving train A records a frequency of $5.5kHz$ while the train approaches the siren. During his return journey in a different train B he records a frequency of

$6.0 kHz$ while approaching the same siren. the ratio the velocity of train B to that of train A is

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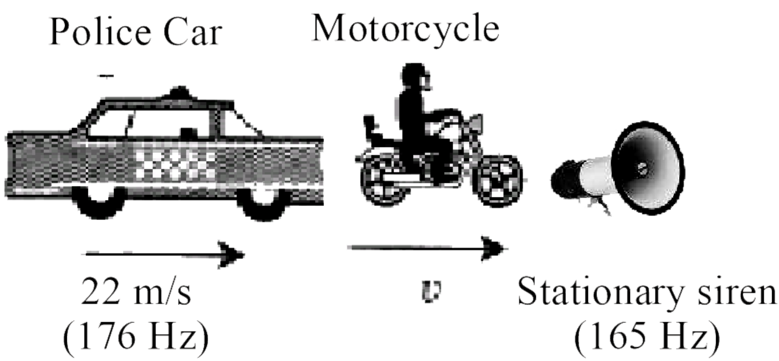
318. A police car moving at 22 m/s, chases a motorcylist. The police man sounds his horn at 176 Hz, while both of them move towards a stationary siren of frequency 165 Hz. Calculate the speed of the motorcycle, if it is given that he does not observes any beats



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319. A tuning fork of frequency $480Hz$ resonates with a tube closed at one end of length $16cm$ and diameter $5cm$ in fundamental mode. Calculate velocity of sound in air.

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320. The length of a sonometer wire is $0.75m$, and density $9 \times 10^3 m$. It can bear a stress of $8.1 \times 10^8 N/m^2$ without exceeding the elastice limit. What is the fundamental frequency that can be produced in the wire?

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321. A transverse sinusoidal wave of amplitude A, wavelength λ and frequency f is travelling along a stretch string. The maximum speed of any point on the string is $\frac{v}{10}$, where, V is the velocity of wave propagation. If $A = 10^{-3}m$, and $V = 10ms^{-1}$, then λ and f are given by

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322. 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 $100Hz$ then the fundamental frequency of the open pipe. The fundamental frequency of the open pipe is

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323. The first overtone of an open orgen pipe beats with the first ouertone of a closed orgen pipe with a beat frequency of $2.2H_Z$. The fundamental frequency of the closed organ pipe is $110H_Z$. Find the lengths of the pipes . Speed of sound in air $u = 330m/s$.

Watch Video Solution

324. A metallic rod of length 1m is rigidly clamped at its mid point. Longirudinal stationary wave are setup in the rod in such a way that there are two nodes on either side of the midpoint. The amplitude of an antinode is $2 \times 10^{-6} m$. Write the equation of motion of a point 2 cm from the midpoint and those of the constituent waves in the rod, (Young,s modulus of the material of the rod $= 2 \times 10^{11} Nm^{-2}$, density $= 8000 kg - m^{-3}$). Both ends are free.

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325. A string of mass 2.50kg is under a tension of 200N.The length of the stretched string is 20.0 m. If a transverse jerk is struck at one end of the string, how long does the disturbance take to reach the other end ?

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326. A stone dropped from the top of a tower of height 300 m high splashes into the water of a pong near the base of the tower. When is the splash heard at the top ? Given that the speed of sound in air is $340ms^{-1}$? $\left(g = 9.8ms^{-2}\right.$.

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327. A steel wire has a length of 12.0 m and a mass of 2.10 kg . What should be the tension in the wire so that speed of a transverse wave on the wire equals the speed of sound in dry air at $20^{\circ}C = 343ms^{-1}$

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328. Use the formula $v = \sqrt{\frac{\gamma P}{\rho}}$ to explain why the speed of sound in air

(a) is independent of pressure, (b) increases with temperature, (c) increases with humidity.

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329. Use the formula $v = \sqrt{\frac{\gamma p}{\rho}}$ to explain why the speed of sound in air increases with temperature.

Watch Video Solution

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(a) is independent of pressure, (b) increases with temperature, (c) increases with humidity.

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331. You have learnt that a travelling wave in a dimension is represented by a funcation $y = f(x, t)$ where x and t must appear in the combination $x - vt$ or $x + vt$, i.e $y = f(x \pm vt)$. Is the coverse true? (Examine if the following funcations for y can possibly represent a travelling wave :

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

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

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

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

Watch Video Solution

335. A bat emits ultrasonic sound of frequency 100 kHz in air. If this sound meets a water surface, the wavelengths of the reflected and transmitted sound are (Speed of sound in air = 340 m s^{-1} and in water = 1500 m s^{-1})

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336. A hospital uses an ultrasonic scanner to locate tumour in a tissue. What is the wavelength of sound in a tissue in which the speed of sound is $1.7 km/s$? The operating frequency of the scanner is $4.2 MHz$.

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337. A transverse harmonic wave on a strin is decribed by

$y(x, t) = 3.0 \sin(36t + 0.018x + \pi/4)$

Where x and y are in cm and t in s. The positive direction of x is from left to right.

(a) Is this a travelling wave or a stationary wave ?

If it is travelling, what are the speed and direction of its propagation ?

(b) What are its amplitude and frequency ?

(c) What is the initial phase at the starting point ?

What is the least distance between two successive crests in the wave ?

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(b) What are its amplitude and frequency ?

(c) What is the initial phase at the starting point ?

What is the least distance between two successive crests in the wave ?

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341. A transverse harmonic wave on a string is described by $y(x, t) = 30 \sin\left(36t + 0.018x + \frac{\pi}{4}\right)$ where x and y are in cm and t is in s.The positive direction of x is from left to right.

What are its amplitude and frequency ?

Watch Video Solution

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

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346. The transvers displacement of a string (clamped at its both ends) is given by

$$y(x, t) = 0.06\sin\left(\frac{2\pi}{3}s\right)\cos(120\pi t)$$

Where x and y are in m and t in s. The length of the string $1.5m$ and its mass is $3.0 \times 10^{-2}kg.$

Answer the following :

(a) Does the funcation represent a travelling wave or a stational wave ?

(b) Interpret the wave as a superposition of two waves travelling in opposite directions. What is the wavelength. Frequency and speed of each wave ?

Datermine the tension in the string.

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347. 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 $3.0 \times 10^{-2} kg$.

Watch Video Solution

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where x, y are in m and t is in s.

Do all the points on the string oscillate with theh same

(a) frequency (b) phase (c) amplitude

Explain your answer.

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353. Given below are some functions of x and t to represent the displacement (transverse or longitudinal) of an elastic wave. State which of these represent (i) a travelling wave, (ii) a stationary wave or (iii) none at all

(a) $y = 2cis(3x)\sin(10t)$

(b) $y =$

(c) $y = 3\sin(5x - 0.5t) + \cos(5x - 5t)$

(d) $y = \cos x \sin t + \cos 2x \sin 2t$

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357. A wire stretched between two rigid supports vibrates in its fundamental mode with a frequency of 45Hz. The mass of the wire is 3.5×10^{-2}kg and its linear mass density is $4.0 \times 10^{-2} kgm^{-1}$. What is (a) the speed of a transverse wave on the string , and (b) the tension in the string?

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358. A wire stretched between two rigid supports vibraes in its fundamental mode with a frequency of45 Hz. The mass of the wire is $3.5 \times 10^{-2} kg$ and its linear mass density is$4.0 \times 10^{-2} kgm^{-1}$. What is (a) the speed of transverse wave on the string and (b) the tension in the string ?

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359. A metre-long tube open at one end, with a movable piston at the other end, shows resonance with a fixed frequency source (a tuning fork of frequency 340Hz) when the tube length is 25.5cm or 79.3cm. Estimate the speed of sound in air at the temperature of the experiment. The edge effects amy be neglected.

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360. A steel rod 100 cm long is clamped at its middle. The fundamental frequency of longitudinal vibrations of the rod is given to be 2.53k Hz. What is the speed of sound in steel?

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361. A pipe 20cm long is closed at one end. Which harmonic mode of the pipe is resonantly excited by a 430Hz source? Will the same source be in resonance with the pipe if both ends are open? Take speed of sound in air $340m/s$.

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362. Two sitar strings A and B playing the note 'Ga' are slightly out of tune and produce beats of frequency 6 Hz. The tension in the string A is slightly reduced and the beat frequency is found to reduce to 3 Hz. If the original frequency of A is 324 Hz, what is the frequency of B?

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363. Explain why (or how) : (a) In a sound wave, a displacement node is a pressure antinode and vice-versa,

(b) Bats can ascertain distances, directions, nature and size of obstacles without any eyes,

(c) a violin note and sitar note may have the same frequency, yet we can distinguish between the two notes, (d) Solids can support both longitudinal and transverse waves, but only longitudinal waves can propagate in gases,

(e) The shape of pulse gets distorted during propagation in a dispersive medium.

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368. A train, standing at the outer signal of a railway station blows a whistle of frequency 400Hz in still air. (i) What is the frequency of the whistle for a platform observer when the train (a) approaches the platform with a speed of $10ms^{-1}$, (b) receeds from the platform with a speed of $10ms^{-1}$? (ii) What is the speed of sound in each case ? The speed of sound in still air can be taken as $340ms^{-1}$

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Watch Video Solution

370. A train, standing in a stationyard, blows a whistle of frequency 400Hz in still air. The wind starts blowing in the direction from the yard to the station at a speed of $10ms^{-1}$. What are the frequency, wavelength, and speed of sound for an observer standing on the station's platform ? Is the situation exactly identical to the case when the air is still and the observer runs towards the yard at a speed of $10ms^{-1}$? Th speed of sound in still air can be taken as $340ms^{-1}$.

Watch Video Solution

371. 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,

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372. A travelling harmonic wave on a string is described by $y(x, t) = 7.5 \sin(0.0050x + 12t + \pi / 4)$ (a) what are the displacement and velocity of oscillation of a point at $x = 1cm$, and $t = 1s$? Is this velocity equal to the velocity of wave propagation ?

(b) Locate the point of the string which have the same transverse displacement and velocity as $x = 1cm$ point at $t = 2s, 5s$ and 11s.

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373. The equation y = 5 sin2π(x - 2t) represents a wave in which the distances are in metres and time in seconds, find the wave speed ?

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374. A narrow sound pulse (for example, a short pip by a whistle) is sent across a medium. (a) Does the pulse have a definite (i) wavelength, (ii) frequency, (iii) speed of propagation ? (b) If the pulse rate is 1 after every $20s$, (i.e. the whistle is blown for a split second after every $20s$) is the frequency of the note produced by the whistle equal to $\frac{1}{20} = 0.05Hz$?

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

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376. One end of a long string of linear mass dnesity $8.0 \times 10^{-3} kgm^{-1}$ is connected to an electrically driven tuning fork of frequency 256 Hz. The other end passes over a pulley and is tied to a pan containing a mass of 90 kg. The pulley end absorbs all the incoming energy so that reflected waves at this end have negligible amplitude. At $t = 0$ the left end (fork end) of the string $x = 0$ has zero transverse displacement $(y = 0)$ and is moving along positive y-direction. The amplitude of the wave is 5.0 cm. Write down the transverse displacement y as function of x and t that describest the wave on the string.

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377. A SONAR system fixed in a submarine operates at a frequency 40.0kHz. An enemy submarine moves towards the SONAR with a speed of 360 kmh^{-1}. What is the frequency of sound reflected by the submarine ? Take the speed of sound in water to be 1450 ms^{-1}.

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378. Earthquakes generate sound waves inside the earth. Unlike a gas, the earth can experience both transverse (S) and longitudinal (P) sound waves. Typically, the speed of S wave is about 4.0 km s^{-1}, and that of P wave is 8.0 kms^{-1}. A seismograph records P and S waved from an earthquake. The first P wave arrives 4 min before the first S wave. Assuming the waves travel in straight line, how far away does the earthquake occur?

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379. A bat is flitting about in a cave, navigating via ultrasonic beeps. Assume that the sound emission frequency of the bat is 40kHz. During one fast swoop directly toward a flat wall surface. The bat is moving at 0.03 times the speed of sound in air. What frequency does the bat hear reflected off the wall ?

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EXERCISE

1. A radio station broadcasts its programme at 219.3 metre wavelength. Determine the frequency of radio wave is velocity of radio waves be $3 \times 10^8 ms^{-1}$.

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2. The audible range of a human ear is 20 Hz to 20 kHz. Convert this into corresponding wavelength range. The speed of sound at ordinary temperature is $340m/s$.

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3. The speed of a wave in a mediium is $960ms^{-1}$. If 3600 waves are passing through a point in medium in 1 minute. What is the wavelength of waves?

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4. If the splash is hear 4.23 seconds after a stone is dropped into a well, 78.4 metres deep, find the velocity of sound in air.

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5. A stone is dropped into a well and its splash is heard at the mouth of the well after an interval of 1.45 s.Find the depth of the well. Given that velocity of sound in air at room temperature is equal to $332ms^{-1}$.

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6. A body sends waves 100mm long through medium A and 0.25m long in medium B. If the velocity of waves in medium A is $80cms^{-1}$, calculate the velocity of waves in medium B.

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7. A steel wire 70cm long has a mass of 7.0g. If the wire is under a tension of 100N, what is the speed of transverse waves in the wire?

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8. The speed of a transverse wave in a stretched string is 348 ms^{-1}, when the tension of the string is 3.6 kg wt. Calculate the speed of the transverse wave in the same string . If the tension in the string is changed to 4.9 kg wt ?

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9. Calculate the velocity of transverse wave in a copper wire 1 mm^2 in cross-section, under the tension produced by 1 kg wt. The density of copper =$8.93kgm^{-3}$

A. e 1mm2 in cross section, under the tension produced by 1kg wt.The density of copper=8.93kgm-3

B.

C.

D.

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10. A wave pulse is travelling on a string of linear mass density $1.0gcm^{-1}$ under a tension of 1 kg wt. Calculate the time taken by the pulse to travel a distance of 50 cm on the string.Given $g = 10ms^{-2}$.

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11. The diameter of an iron wire is 1.20 mm. If the speed of transverse waves in the wire is $50.0m/s$, what is the tension in the wire? The density of iron is $7.7 \times 10^3 kg/m^3$

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12. The speed of sound in a liquid is $1500ms^{-1}$.The density of the liquid is $1.0 \times 10^3 kgm^{-3}$.Determine the bulk modulus of elasticity of the liquid.

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13. The longitudinal waves starting from a ship return from the bottom of the sea to the ship after 2.64 s. If the bulk modulus of water be $220mm^{-2}$ and the density $1.1 \times 10^{3} kgm^{-3}$.calculate the depth of the sea. Take g =$9.8Nkg^{-1}$.

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14. At $10^{5} Nm^{-2}$ atmospheric pressure the density of air is $1.29kgm^{-3}$.If $\gamma = 1.41$ for air, calculate the speed of sound in air.

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15. At normal temperature and pressur, 4g of He occupies a volume of 22.4 litre. Determine the speed of sound in helium. Take 1 atmospheric pressure $= 10^{5} N/m^{2}$ and γ for helium $= 1.67$.

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16. Find the temperature at which the velocity of sound in air will be $1\frac{1}{2}$ times the velocity at $11^{\circ}C$.

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17. The velocity of sound in air is $332ms^{-1}$ at $0^{\circ}C$ .At what temperature will the velocity become 1/2 time that at $0^{\circ}C$?

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18. 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 $\sqrt{\frac{21}{3}}$.

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19. An observer sets his watch by the sound of a signal fired from a tower yet he finds that his watch is slow by 5 s. Find the distance of the tower from the observer.The temperature of air during the observation is $20^{\circ} C$ and the velocity of sound in air at $0^{\circ} C$ is $332 m s^{-1}$.

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20. A sound wave propagating in air has a frequency of 4000Hz. Calculate the percentage change in wavelength when the wavefront initially in a region where $T = 27^{\circ} C$ enters a region where temperature decreases to $10^{\circ} C$.

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21. The speed of sound in dry air at NTP is 332 metres $/$sec. Assuming air as composed of 4 parts of nitrogen and one part of oxygen, calculate velocity of sound in oxygen under similar conditions, when the densities of oxygen and nitrogen at NTP are in the ration of $16:14$ respectively .

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22. A wave on a string is described by $y(x, t) = 0.005 \sin(6.28x - 314t)$, in which all quantities are in SI units. Calculate its amplitude and wavelength.

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Watch Video Solution

24. The equation of a transverse wave travelling along a coil spring is

$y = 4.0 \sin \pi(0.010x - 2.0t)$

where y and x are in cm and t in s. Find the (i)amplitude (ii)wavelength (iii)initial phase at the origin (iv)speed and (v)frequency on the wave.

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25. The equation of a transverse wave travelling along a coil spring is

$y = 4.0 \sin \pi(0.010x - 2.0t)$

where y and x are in cm and t in s. Find the (i)amplitude (ii)wavelength (iii)initial phase at the origin (iv)speed and (v)frequency on the wave.

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26. The equation of a transverse wave is given by

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

where x and y are in cm and t is in second. Its frequency is

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29. The equation of a plane progressive wave is give by equation

$y = 10 \sin 2\pi(t - 0.005x)$

where y and x are in cm and t is in seconds. Calculate the amplitude, frequency, wavelength and velocity of the wave.

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where y and x are in cm and t is in seconds. Calculate the amplitude, frequency, wavelength and velocity of the wave.

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33. A simple harmonic wave is expressed by equation,

$y = 7 \times 10^{-6} \sin\left(800\pi t - \frac{\pi}{42.5}x\right)$

where y and x are in cm and t is in second.

Calculate (i) amplitude (ii) frequency

(iii) wavelength)

(iv) wave velocity

(v) Phase difference between two particles separated by 17.0cm.

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Calculate (i) amplitude (ii) frequency

(iii) wavelength)

(iv) wave velocity

(v) Phase difference between two particles separated by 17.0cm.

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37. A simple harmonic progressive wave is representive by the equation $y = 8 \sin 2\pi(0.1x - 2t)$ where x and y are in centimetres and t is in seconds. At any instant the phase difference between two particle separted by 2.0 cm along the x-direction is

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38. For a travelling harmonic wave , $y = 2.0 \cos(10t - 0.0080x + 0.818)$ where x and y are in cm and t is in sec. What is the phase difference between two points separated by (i) a distance of 0.5m (ii) time gap of 0.5s.

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39. For a travelling harmonic wave , $y = 2.0 \cos(10t - 0.0080x + 0.818)$ where x and y are in cm and t is in sec. What is the phase difference between two points separated by (i) a distance of 0.5m (ii) time gap of 0.5s.

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40. Find the displacement of an air particle 3.5 m from the origin of disturbance at t=0.05 s, when a wave of amplitude 0.2 mm and frequency 500 Hz travels along it with a velocity $350ms^{-1}$.

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41. A simple harmonic wave-train is travelling in a gas in the positive direction of the X-axis.Its amplitude is 2 cm, velocity $45ms^{-1}$ and frequency $75s^{-1}$.Write down the equation of the wave Find the displacement of the particle of the medium at a distance of 135 cm from the origin in the direction of the wave at the instant t=3 s.

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43. The phase difference between the vibrations of two medium particles due to the transmission of a wave is $2\pi/3$.The distance between the particles is 15 cm.Determine the wavelength of the wave.

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44. The distance between two particles on a string is 10 cm. If the frequency of wave propagating in it is 400 Hz and its speed is 100 m/s then the phase difference between the particles will be

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45. A sound source of frequency 500 Hz is producing longitudinal waves in a spring.The distance between two consecutive rarefractions is 24 cm.If the amplitude of vibration of a particle of the spring is 3.0 cm and the wave is travelling in the negative x-direction, then write the equation for the wave.Assume that the source is at x=0 and at this point the displacement is zero at the time t=0.

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46. The distance between two consecutive nodes in a stationary wave is 25cm. If the speed of the wave is $250 m s^{-1}$, calculate the frequency.

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47. The equation of a longitudinal stationary wave produced in a closed organ pipe is

$$y = 6\frac{\sin(2\pi x)}{6}\cos 160\pi t$$

where x, y are in cm and t in second.Find (i)the frequency , amplitude and wavelength of the original progressive wave (ii)separation between two successive nodes .

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where x, y are in cm and t in second.Find (i)the frequency , amplitude and wavelength of the original progressive wave (ii)separation between two successive nodes .

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52. Write the equation of a wave identical to the wave represented by the equation $y = 5\sin\pi(4.0t - 0.02x)$, but moving in opposite direction. Write the equation of stationary wave produced by the combination of these two waves. Determine the distance between two nearest nodes. All distances in the equations are in mm.

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55. A sonometer wire is under a tension of 40 N and the length between the bridges is 50 cm. A metre long wire of the sonometer has a mass of 1.0 g. Determine its fundamental frequency.

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56. A cord 80 cm long is stretched by a load of 8.0 kg f.The mass per unit length of the cord is $4.0 \times 10^{-5} kgm^{-1}$.Find (i)speed of the transverse wave in the cord and (ii)frequency of the fundamental and that of the second overtone.

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57. The length of a stretched wire is 1 m and its fundamental frequency is 300 Hz.What is the speed of the transverse wave in the wire ?

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58. The mass of 1m long steel wire is 20 g. The wire is stretched under a tension of 800N. What are the frequencies of fundamental mode of vibration and next two higher modes ?

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59. If the tension in the string is increased by 5 kg wt, the frequency of the fundamental tone increases in the ratio 2:3.What was the initial tension in the string ?

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60. A sonometer wire has a length of 114 cm between its two fixed ends. Where should the two bridges be places so as to divide the wire into three segments, whose fundamental frequencies are in the ratio $1:3:4$?

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61. Two wires of the same material are stretched with the same force. Their diameters are 1.2 mm and 1.6mm, while their lengths are 90 cm and 60cm respectively. If the frequency of vibrations of first is 256 Hz, find that of the other.

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62. A guitar string is 90 cm long and has a fundamental frequency of 124 Hz. Where should it be pressed to produce a fundamatal frequecy of 186 Hz?

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63. The ratio of frequencies of two wires having same length and same tension and made of the same material is 2:3.If the diameter of one wire be 0.09 cm , then determine the diameter of the other.

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64. A 50 cm long wire is in unison with a tuning fork of frequency 256, when stretched by a load of density $9gcm^{-3}$ hanging vertically . The load is then immersed in water.By how much the length of the wire be reduced to bring it again in unison with the same tuning fork ?

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65. A string vibrates with a frequency of 200Hz. Its length is doubled and its tension is altered till it begins to vibrate with a frequency of 300Hz. What is the ratio of new tension to the original tension ?

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66. In Melde's experiment , a string vibrates in 3 loops when 8 grams were placed in the pan.What mass must be placed in the pan to make the string vibrate in 5 loops ?

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67. An open organ pipe produces a note of frequency 512 Hz at $15^{\circ} C$, calculate the length of the pipe.Velocity of sound at $0^{\circ} C$ is $335 ms^{-1}$.

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68. Find the frequencies of the fundamental note and first overtone in an open air column and a closed air column of length 34 cm. The velocity of sound at room temperature is $340 ms^{-1}$

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69. Prove that a pipe of length 2l open at both ends has same fundamental frequency as another pipe of length l closed at the other end. Also, state whether the total sound will be identical for two pipes.

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70. The funadamental frequency of a closed organ pipe is equal to the first overtone frequency of an open organ pipe. If the length of the open pipe is 60 cm, what is the length closed pipe?

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71. The fundamental tone produced by an organ pipe has a frequency of 110 Hz. Some other frequencies produced by the pipe are 220, 440, 550, 660 Hz. Is this pipe open or closed?Calculate effective length of the pipe. Speed of sound is $330 m/s$.

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72. An open organ pipe has a fundamental frequency of $300Hz$. The first overtone of a closed organ pipe has the same frequency as the first overtone of the open pipe . Find length of each pipe . The velocity of sound in air $= 350m / s.$

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73. Find the ratio of the length of a closed pipe to that of an open pipe in order that the second overtone of the former is in unison with fourth overtone of the latter.

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74. A tuning fork of frequency 341 Hz is vibrated just over a tube of length 1m. Water is being poured gradually in the tube. What height of water colume will be required for resonance?Speed of sound in air is $341 \text{ m} / \text{s}$.

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75. A resonance air column shows resonance with a tuning fork of frequency 256 Hz at column lengths 33.4 cmand 101.8 cm. find (i) end-correction and (ii) the speed of sound in air.

Watch Video Solution

76. A resonance air column shows resonance with a tuning fork of frequency 256 Hz at column lengths 33.4 cmand 101.8 cm. find (i) end-correction and (ii) the speed of sound in air.

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77. A metallic bar clamped at its middle point vibrates with a frequency v when it is rubbed at one end. If its length is doubled, what will be its natural frequency of vibration ?

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78. When two tuning forks were sounded together , 20 beats were produced in 10 seconds. On loading one of the fork with wax, the number of beats increases. If the frequency of unloaded fork is 512Hz , calculate the frequency of other.

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79. A tunning fork of unknown frequency gives 4 beats per second when sounded with a fork of frequency 320 Hz. When loaded with little wax, it gives 3beats per second. Find the unknown frequency. [

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80. A tuning fork A makes 4 beats per second with a fork B of frequency 256 Hz. A is filed and the beats occur at shorter interval, find its original frequency.

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81. A set of 25 tuning forks is arranged in order of decreasing frequency. Each fork gives 3 beats with succeeding one. The first fork is octave of the last. Calculate the frequency of the first and 16th fork.

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82. The string of violin emits a note of 440 Hz at its correct tension. The string is bit taut and produces 4 bets er second with a tunning fork of frequency 440 Hz. Find the frequency of the note emitted by this taut string.

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83. A tuning fork when vibrating along with a sonometer produces 6 beats per second when the length of the wire is either 20 cm or 21 cm . Find the frequency of the tuning fork.

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84. A 70 cm long sonometer wire is in unison with a tuning fork. If the length of the wire is decreased by 1.0 cm, it produces 4 beats per second with the same tuning fork. Find the frequency of the tuning

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85. When two timing forks are sounded together, 4 beats per second are heard. One of the forks is in unison with 0.96 m length of a sonometer wire and the other is in unison with 0.97 m length of the same wire. Calculate the frequency of each

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86. In an experiment, it was found that a tuning fork and sonometer wire gave 5 beats per second, both when the length of wire was 1m and 1.05m. Calculate the frequency of the fork.

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87. A and B are two wires whose fundamental frequencies are 256 and 382 Hz respectively. How many beats in 2 seconds will be heard by the third harmonic of A and second harmonic of B?

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88. In an experiment, it was found that a tuning fork and sonometer wire gave 5 beats per second, both when the length of wire was 1m and 1.05m. Calculate the frequency of the fork.

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89. A tuning fork of frequency 300Hzresonates with an air column closed at one end at 27°C. How many beats will be heard in the vibrations of the fork and the air column at 0°? End correction is negligible.

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90. A policeman blows a whistle with a frequency of 500 Hz.A car approaches him with a velocity of $15ms^{-1}$.Calculate the change in frequency as heard by the driver of the car as he passes the policeman.Speed of sound in air is $300ms^{-1}$.

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91. Calculate the apparent frequency of the horn of a car approaching a stationary listener with a velocity of $12ms^{-1}$. The frequency of horn is 500 Hz.The speed of sound is $332ms^{-1}$.

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92. A man standing near a railway line hears the whistle of an engine, which has a velocity of $20ms^{-1}$.What frequency does the man hear, when the engine is coming towards and going away from him, if the true frequency of the whistle is 1000 Hz ? Speed of sound in air = $340ms^{-1}$

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93. Two engines pass each other in opposite directions with a velocity of $60kmh^{-1}$ each. One of them is emitting a note of frequency 540. Calculate the frequencies heard in the other engine before and after they have passed each other. Given velocity of sound = $316.67ms^{-1}$.

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94. A train approaches stationary observer, the velocity of train being $\frac{1}{20}$ of the velocity of sound. A sharp blast is blown with the whistle of the engine at equal intervals of 1s. The interval between the successive blasts as heard by the observer

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95. When a source moves away from a stationary observer, the frequency is $\frac{6}{7}$ times the original frequency. Given: speed of sound $= 330\frac{m}{s}$. The speed of the source is

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96. A motor car is approaching towards a crossing with a velocity of $75 kmh^{-1}$.The frequency of sound of its horn as heard by a policeman standing on the crossing is 260 Hz.What is the real frequency of the horn ? Speed of sound =$332 ms^{-1}$.

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97. Two cars are approaching each other on a straight road and moving with a velocity of$30 kmh - 1$. If the sound produced in a car is of frequency 500 Hz, what will be the frequency of sound as heard by the person sitting in the other car ? When the two cars have crossed each other and are moving away from each other, what will be the frequency of sound as heard by the same person ? Speed of sound= $330 ms^{-1}$.

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98. A source emitting sound of frequency 1000 Hz is moving towards an observer at speed $v_s = 0.90v$, (where v is the velocity of sound). What frequency III will be heard by the observer ?

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99. A policeman on duty detects a drop detects a drop of 15% in the pitch of the horn of a motor car as it crossed him. If the velocity of sound is $330 metre / \sec.$, calculate speed of the car.

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100. The whistle of an engine moving at $30 km / h$ is heard by a motorist driving at $15 km / h$ and he estimated the pitch to be 500. What would be the actual pitch if two are approaching each other ? Velocity of sound is 1220km//h .

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101. A car passing a check post gives sound of frequency 1000 c.p.s. If the velocity of the car is $72km/h$ and of sound is $350m/s$, find the change is apparent frequency as it crosses the post.

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102. Light can travel in vacuum but sound cannot travel. Explain.

A. speed of sound is very slow than light

B. light waves are electromagnetic in nature

C. sound waves are electromagnetic in nature

D. none of the above

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103. The disc of a siren containing 60 holes rotates at a constant speed of 360 rpm . The emitted sound is in unison with a tuning fork of frequency

A. 10 Hz

B. 360 Hz

C. 216 Hz

D. 60 Hz

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104. The speed of a wave in a medium is 760 m/s. If 3600 waves are passing through a point in the medium in 2 min, then their wavelength is

A. 13.8 m

B. 41.5 m

C. 25.3 m

D. 57.2 m

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105. A tuning fork makes 256 vibrations per second in air. When the speed of sound is $330m/s$, the wavelength of the note emitted is :

A. 0.56 m

B. 1.11 m

C. 0.89 m

D. 1.29 m

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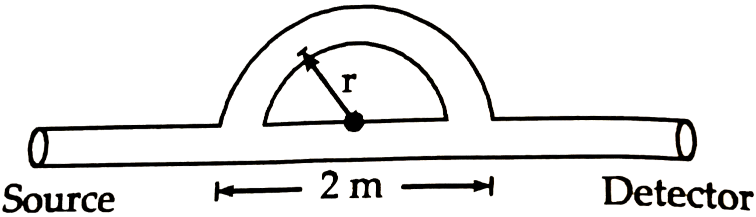
106. A tuning fork of frequency 250 Hz is vibrating at one end of a tube as shown in the figure. If maximum sound is heard at the other end, then the velocity of the waves will be



A. $58ms^{-1}$

B. $580ms^{-1}$

C. $20ms^{-1}$

D. $116ms^{-1}$

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107. The wavelength difference of light waves of the wave numbers 2×10^{6} per m and $2\ 25 \times 10^{6}$ per m is

A. $0.556 \times 10^{-6} m$

B. $0.0556 \times 10^{6} m$

C. $0.0556 \times 10^{-6} m$

D. $0.556 \times 10^{6} m$

Watch Video Solution

108. The disc of siren has n holes and the frequency of its rotation is 300 rpm. It produces a notes of wavelength 2.4 m. If the velocity of sound in air is 360 m/s, then the value of n will be

A. 8

B. 24

C. 24

D. 30

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109. The frequency of tuning fork is 256 Hz. It will not resonate with a fork of frequency

A. 768 Hz

B. 738 Hz

C. 512 Hz

D. 256 Hz.

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110. The velocity of transverse wave in a stretched string is proportional to

A. $\frac{1}{\sqrt{T}}$

B. $\sqrt{T}$

C. T

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

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

A. 60 N

B. 40 N

C. 50 N

D. 30 N

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112. The speed (v) of ripples on the surface of waterdepends on surface tension (σ), density (ρ) and wavelength (λ). The square of speed (v) is proportional to

A. $\frac{\sigma}{\rho\lambda}$

B. $\frac{\rho}{\sigma\lambda}$

C. $\frac{\lambda}{\sigma\rho}$

D. $\rho\lambda\sigma$

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113. Velocity of sound in air is

A. faster in dry air than in moist air

B. directly proportional to temperature

C. directly proportional to pressure

D. none of the above

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114. If at same temperature and pressure, the densities for two diatomic gases are respectively d_1 and d_2 , then the ratio of velocities of sound in these gases will be

A. $\sqrt{\frac{d_2}{d_1}}$

B. d_1d_2

C. $\sqrt{\frac{d_1}{d_2}}$

D. $\sqrt{d}_1d_2$

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115. If the density of oxygen is 16 times that of hydrogen, what will be the ratio of their corresponding velocities of sound waves

A. $1:4$

B. $16:1$

C. $4:1$

D. $1:16$

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116. The ratio of velocity of sound in hydrogen and oxygen at STP is " "

[2005]

A. $16:1$

B. $8:1$

C. $4:1$

D. $2:1$

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117. At what temperature the speed in sound in air will become double of its value at 27°?

A. $54^o C$

B. $627^o C$

C. $327^{o}C$

D. $927^{o}C$

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118. It takes 2.0 seconds for a sound wave to travel between two fixed points when the day temperature is $10^{\circ}C$. If the temperature rise to $30^{\circ}C$ the sound wave travels between the same fixed parts in

A. 1.9 sec

B. 2.0 sec

C. 2.1 sec

D. 2.2 sec

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119. A balloon is filled with hydrogen. For sound waves, this balloon behaves like

A. a converging lens

B. a diverging lens

C. a concave mirror

D. none of the above

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120. A particle on the trough of a wave at any instant will come to the mean position after a time (T = time period)

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

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

C. T

D. 2T

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

A. $v_p = \frac{\omega}{k}$

B. $v_p = d\frac{\omega}{d}k$

C. $v_p = c$

D. $v_p = \frac{c}{v_g}$

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122. If the equation of transverse wave is $y = 5 \sin 2\pi \left[\frac{t}{0.04} - \frac{x}{40}\right]$, where distance is in cm and time in second, then the wavelength of the wave is

A. 20 cm

B. 40 cm

C. 60 cm

D. none of these

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123. A wave is expressed by the equation

$y = 0.5 \sin \pi(0.01x - 3t)$

where y and x are in metre and t in seconds. Find the speed of propagation.

A. 150 m/s

B. 300 m/s

C. 350 m/s

D. 250 m/s

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124. If the wave equation $y = 0.08\frac{\sin(2\pi)}{\lambda}(200t - x)$ then the velocity of the wave will be

A. 150 units

B. $150\sqrt{2}$ units

C. 300 units

D. $300\sqrt{2}$ units

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125. The equation of a wave travelling on a string is $y = 8\sin\left[\frac{\pi}{2}\left(4t - \frac{x}{16}\right)\right]$, where x, y are in cm and t in second. The 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

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

A. 0.04

B. 0.01

C. 1

D. 5

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127. A wave equation is y=0.01 sin $(100\pi t - kx)$ of wave velocity is 100 m/s, its number is equal to

A. $1m^{-1}$

B. $2m^{-1}$

C. πm^{-1}

D. $2\pi m^{-1}$

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128. A transverse wave is represented by the equation

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

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

A. $y_0 \frac{\pi}{2}$

B. $2y_0\pi$

C. $y_0\pi$

D. $y_0 \frac{\pi}{4}$

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129. If wave y = A cos $(\omega t + kx)$ is moving along x-axis The shape of pulse at t = 0 and t = 2 s

A. are different

B. are same

C. may not be same

D. none of these

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130. The phase difference between two waves represented by $y_1 = 10^{-6} \sin[100t + (x/50) + 0.5]m$, $y_2 = 10^{-6} \cos[100t + (x/50)]m$ where x is expressed in metres and t is expressed in seconds, is approximately

A. 1.07 rad

B. 2.07 rad

C. 0.5 rad

D. 1.5 rad

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131. y_1=4sin(ωt + kx), y2 = -4 cos(ωt + kx), the phase difference is

A. $\pi/2$

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

C. π

D. zero

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132. Equation of a plane wave is given by $4\sin.\ \frac{\pi}{4}\left[2t+\frac{x}{8}\right]$. The phase difference at any given instant of two particles 16 cm apart is

A. 60^{o}

B. 90^o

C. 30^o

D. 120^o

Watch Video Solution

133. The phase difference between two points separated by 1m in a wave of frequency 120 Hz is 90° . The wave velocity is

A. 720 m/s

B. 480 m/s

C. 240 m/s

D. 180 m/s

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134. Sound travels in air if :

A. wavelength

B. frequency

C. velocity

D. all of these

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135. An underwater sonar source operating at a frequency of 60 kHz directs its beam towards the surface. If velocity of sound in air is 330 m/s, wavelength and frequency of the waves in air are :-

A. 5.5 mm, 60 kHz

B. 330 m, 60 kHz

C. 5.5 mm, 30 kHz

D. 5.5 mm, 80 kHz

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136. Two waves of same amplitude a and frequency v and having a phase difference of $\pi/2$ radian, are superposed. The amplitude of resultant wave is

A. $\frac{a}{\sqrt{2}}$, f/2

B. $\frac{a}{\sqrt{2}}$, f

C. 2a, f/2

D. $\sqrt{2}a$,f

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137. Two waves are represented by $y_1 = a\sin\left(\omega t + \frac{\pi}{6}\right)$ and $y_2 = a\cos\omega t$. What will be their resultant amplitude

A. a

B. $\sqrt{2}a$

C. $\sqrt{3}a$

D. 2a

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138. Consider the three waves z_1, $z_2$andz_3 as

$$z_1 = A\sin(kx - \omega t)$$

$$z_2 = A\sin(kx + \omega t)$$

$$z_3 = A\sin(ky - \omega t)$$

Which of the following represents a standing wave?

A. $z_1 + z_2$

B. $z_2 + z_3$

C. $z_3 + z_1$

D. $z_1 + z_2 + z_3$

Watch Video Solution

139. A pulse of a wavetrain travels along a stretched string and reaches the fixed end of the string. It will be reflected back with

A. the same phase as the incident pulse but with velocity reversed

B. a phase change of 180^o with no reversal of velocity

C. the same phase as the incident pulse with no reversal of velocity

D. a phase change of 180^o with velocity reversed

Watch Video Solution

140. Which one of the following statements is incorrect for stable interference to occur between two waves?

A. the same amplitude travelling in the same direction with no please difference between

B. the same amplitude, travelling in the opposite direction with no phase differnce between them

C. different amplitudes travelling in the same direction

D. different amplitude travelling in the opposite direction

Watch Video Solution

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

A. A cos(kx + ωt)

B. -Acos(kx +ωt)

C. A sin(kx +ωt)

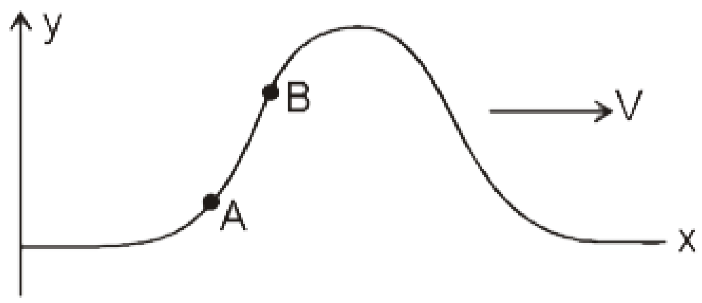
D. -A sin(kx +ωt)

Watch Video Solution

142. A wave pulse is generated in a string that lies along x-axis. At the points A and B, as shown in figure, if

R_A and R_B

are ratio of wave speed to the particle speed respectively then :



A. in same time

B. time difference is T 14 (B is lagging)

C. time difference is T / 2 (B is lagging)

D. time difference is T / 4 (A is lagging)

Watch Video Solution

143. Stationary waves are setup in an air column. Velocity of sound in air is $330ms^{-1}$ and frequency is $165Hz$. The distance between two successive nodes is

A. $\lambda/4$

B. $\lambda/2$

C. λ

D. 2λ

Watch Video Solution

144. The tension in a piano wire is $10N$. The tension ina piano wire to produce a node of double frequency is

A. 5 N

B. 20 N

C. 40 N

D. 80 N

Watch Video Solution

145. The first overtone of a stretched string of given length is 320 Hz. The first harmonic is

A. 320 Hz

B. 160Hz

C. 480 Hz

D. 640 Hz

Watch Video Solution

146. In an experiment with sonometer, a tuning fork of frequency 256 Hz resonates with a length of 25 cm and another tuning fork resonates with a length of 16 cm. Tension of the string remaining constant, the frequency of the second tuning fork is –

A. 163.84 Hz

B. 400 Hz

C. 320 Hz

D. 204.8 Hz

Watch Video Solution

147. Fundamental frequency of sonometer wire is n. If the length. Tension and diameter of wire are tripled. The new findamental frequency is

A. $n/\sqrt{3}$

B. $n/3$

C. $n\sqrt{3}$

D. $n/3\sqrt{3}$

Watch Video Solution

148. When the length of the vibrating segment of a sonometer wire is increased by 1% the percentage change in its frequency is

A. 100/101

B. 99/100

C. 1

D. 2

Watch Video Solution

149. The correct graph between the frequency n and square root of density ρ of a wire, keeping its length, radius and tension constant, is

Watch Video Solution

150. A string vibrates according to the equation $y = 5\sin\left(\frac{2\pi x}{3}\right)\cos 20\pi t$, where x and y are in cm and t in sec . The distance between two adjacent nodes is

A. 2 cm

B. 4 cm

C. 8 cm

D. 16 cm

Watch Video Solution

151. A wave frequency $100Hz$ travels along a string towards its fixed end . When this wave travels back after reflection , a node is formed at a distance of $10cm$from the fixed end . The speed of the wave (incident and reflected) is

A. 5 m/s

B. 20 m/s

C. 10 m/s

D. 40 m/s

Watch Video Solution

152. A uniform rope of mass 0.1 kg and length 2.5 m hangs from ceiling. The speed of transverse wave in the rope at upper end at a point 0.5 m distance from lower end will be

A. 5 m/s, 2.24 m/s

B. 10 m/s,3.23 m/s

C. 7.5 m/s, 1.2 m/s

D. none of these

Watch Video Solution

153. Resonance is an example of

A. tuning fork

B. free vibration

C. forced vibration

D. damped vibration

Watch Video Solution

154. A resonance air column of length 20 cm resonates with a tuning fork of frequency 250 Hz . The speed of sound in air is

A. 720 m/s

B. 920 m/s

C. 820 m/s

D. 1020 m/s

Watch Video Solution

155. What is minimum length of a tube, open at both ends, that resonates with tuning fork of frequency 350 Hz ? [velocity of sound in air = 350 m/s]

A. 50 cm

B. 100 cm

C. 75 cm

D. 25 cm

Watch Video Solution

156. A closed organ pipe has a frequency $'n'$. If its length is doubled and radius is halved , its frequency nearly becomes .

A. n

B. n/2

C. 2n

D. 4n

Watch Video Solution

157. Five organ pipes are described below. Which one has the highest fundamental frequency ?

A. A 2.3 m pipe with one end open and the other closed

B. A 3.3 m pipe with one end open and the other closed

C. A 1.6 m pipe with both ends open

D. A 3.0 m pipe with both ends open

Watch Video Solution

158. Assume velocity of sound in air as 333.68 ms^{-1}. A hollow brass tube is placed vertically in a jar containing water. Air in the tube is vibrated by a tuning fork of frequency 338 Hz. Neglect end correction. Second resonance is obtained when the length of air column in the brass tube is

A. 0.215 m

B. 0.43 m

C. 0.645 m

D. 0.33 m

Watch Video Solution

159. If the length of a closed organ pipe is 1m and velocity of sound is 330 m/s , then the frequency for the second note is

A. $4 \times \frac{330}{4} Hz$

B. $2 \times \frac{330}{4} Hz$

C. $3 \times \frac{330}{4} Hz$

D. $2 \times \frac{4}{330} Hz$

Watch Video Solution

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

A. at the two ends

B. at the distance l/2 inside the ends

C. at the distance l/4 inside the ends

D. at the distance l/8 inside the ends

Watch Video Solution

161. An open pipe resonates with a tuning fork of frequency $500Hz$. It is observed that two successive notes are formed at distance $16 \text{ and } 46cm$ from the open end. The speed of sound in air in the pipe is

A. 230 m/s

B. 300 m/s

C. 320 m/s

D. 360 m/s

Watch Video Solution

162. In a resonance tube the first resonance with a tuning fork occurs at 16 cm and second at 49 cm . If the velocity of sound is 330 m/s , the frequency of tuning fork is

A. 500

B. 300

C. 330

D. 165

Watch Video Solution

163. An organ pipe open at one end is vibrating in first overtone and is in resonance with another pipe open at both ends and vibrating in third harmonic. The ratio of length of two pipes is–

A. $1:2$

B. $4:1$

C. $8:3$

D. $3:8$

Watch Video Solution

164. Velcity of sound in an open organ pipe of 330m/s. The frequency of wave is 1:1 kHz and the length of tube is 30cm. To which harmoninc does this frequency corresponds?

A. at the two ends

B. 3

C. 4

D. 5

Watch Video Solution

165. A steel rod 100 cm long is clamped at its middle. The fundamental frequency of longitudinal vibrations of the rod is given to be 2.53k Hz. What is the speed of sound in steel?

A. 5.06 km/s

B. 7.06 km/s

C. 6.06 km/s

D. 8.06 km/s

Watch Video Solution

166. Two waves are propagating with same amplitude and nearly same frequency in opposite direction, they result in

A. beats

B. stationary wave

C. resonance

D. wave packet

Watch Video Solution

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

A. interference

B. diffraction

C. reflection

D. refraction

Watch Video Solution

168. For beats to be produced

A. frequency of sources should be different and amplitude should be same

B. frequency of sources should be same and amplitude should be different

C. frequency of sources should be different and amplitude should be different

D. frequency of sources should be same and amplitude should be same

Watch Video Solution

169. A tuning fork A produces 4 beat/s with another tuning fork B of frequency 320 Hz. On filing one of the prongs of A, 4 beat/s are again heard when sounded with the same fork B. Then, the frequency of the fork A before filing is

A. 328 Hz

B. 316 Hz

C. 324 Hz

D. 320 Hz

Watch Video Solution

170. Beats are produced by two waves given by $y_1 = a \sin 2000\pi t$ and $y_2 = a \sin 2008\pi t$. The number of beats heard per second is

A. 8

B. 4

C. 1

D. zero

Watch Video Solution

171. 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

Watch Video Solution

172. Two waves of wavelengths 99 cm and 100 cm both travelling with velocity 396 m/s are made to interfere. The number of beats produced by them per second are

A. 1

B. 2

C. 4

D. 8

Watch Video Solution

173. When the wavelength of sound changes from 1 m to 1.01 m, the number of beats heard per second are 4. The velocity of sound is

A. 404 m/s

B. 4.04 m/s

C. 414 m/s

D. 400 m/s

Watch Video Solution

174. Number of beats between A and B is 5 and between B and C are 3. Number of beats between A and C may be

A. 1

B. 2

C. 8

D. none of these

Watch Video Solution

175. Two closed organ pipes, when sounded simultaneously gave 4 beats per sec. If longer pipe has a length of 1 m. Then length of shorter pipe will be (v=300 m//s`

A. 80 cm

B. 94.9 cm

C. 90 cm

D. 185.5 cm

Watch Video Solution

176. Fifty-six tuning forks are arranged in order of increasing frequencies so that each fork gives 4 beats per second with the next one. The last fork gives the octave of the first. Find the frequency of the first.

A. n = 120

B. n = 180

C. n =160

D. n = 220

Watch Video Solution

177. 50 tunning forks are arranged in increasing order of their frequencies such that each gives 4 beats/sec with its previous tuning fork. If the frequency of the last fork is octave of the first, then the frequency of the first tuning fork is

A. 200 Hz

B. 204 Hz

C. 196 Hz

D. none of these

Watch Video Solution

178. There are 26 tuning forks arranged in the decreasing order of their frequencies. Each tuning fork gives 3 beats with the next. The first one is octave of the last. What is the frequency of 18th tuning fork ?

A. 100 Hz

B. 99 Hz

C. 96 Hz

D. 103 Hz

Watch Video Solution

179. 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. 300 Hz

B. 500 Hz

C. 1000 Hz

D. 400 Hz

Watch Video Solution

180. When beats are produced by two progressive waves of same amplitude and of nearly same frequencies then the maximum loudness of the resulting sound is n times the loudness of each of the component wave trains. The value of n is

A. 3

B. 1

C. 4

D. 2

Watch Video Solution

181. Doppler's effect in sound takes place when source and observer are

A. stationary

B. moving with same velocity

C. in relative motion

D. none of the above

Watch Video Solution

182. The change in frequency due to Doppler effect does not depend on

A. speed of the observer

B. distance between observer and source

C. speed of the source

D. frequency of the source

Watch Video Solution

183. Source of sound and observer are moving towards each other, the observer will hear

A. high frequency, high wavelength

B. low frequency, low wavelength

C. high frequency, low wavelength

D. low frequency, high wavelength

Watch Video Solution

184. A source emits a sound of frequency of 400 Hz , but the listener hears it to be 390 Hz . Then

A. the listener is moving towards the source

B. the source is moving towards the listener

C. the listener is moving away from the source

D. the listener has a defective ear

Watch Video Solution

185. An observer is moving away from source of sound of frequency 100 Hz. His speed is 33 m/s. If speed of sound is 330 m/s, then the observed frequency is

A. 85 Hz

B. 100 Hz

C. 91 Hz

D. 149 Hz

Watch Video Solution

186. 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. 1950 Hz

B. 2132 Hz

C. 2068 Hz

D. 2486 Hz

Watch Video Solution

187. A source of frequency 1 kHz is moving towards a stationary observer with velocity of 0.9 times that of sound. What is the frequency heard by the observer ?

A. 5 kHz

B. 15 kHz

C. 10 kHz

D. 17 kHz

Watch Video Solution

188. A source and a listener are both moving towards each other with speed $v/10$, where v is the speed of sound. If the frequency of the note emitted by the source is f, the frequency heard by the listener would be nearly

A. 1.11 f

B. 1.22 f

C. f

D. 1.27 f

Watch Video Solution

189. A train is approaching with velocity 25 m/s towards a pedestrian standing on the track, frequency of horn of train is 1 kHz. Frequency heard by the pendestrain is (v = 350 m / s)

A. 1077 Hz

B. 1167 Hz

C. 985 Hz

D. 945 Hz

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190. The apparent frequency of a note is 200 Hz when a listener is moving with a velocity of 40 ms^{-1} towards a stationary source. When he moves away from the same source with the same speed, the apparent frequency of the same note is 160 Hz. The velocity of sound in air (in m/s) is :-

A. 340

B. 330

C. 360

D. 320

Watch Video Solution

191. When the source is moving towards the stationary observer, the apparent frequency is given by

A. $n_1 = \dfrac{v + v_0}{v - v_s} n_0$

B. $n_1 = \dfrac{vn}{v + v_s}$

C. $n_1 = \dfrac{vn}{v - v_s}$

D. $n_1 = \dfrac{(v + v_0)n}{v}$

Watch Video Solution

192. A stationary police car sounds a siren with a frequency of 990 Hz. If the speed of sound is 330 m/s, an observer, driving towards the car with a speed of 33 m/s, will hear a frequency of

A. 891 Hz

B. 900 Hz

C. 1089 Hz

D. 1100 Hz

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193. Two trains, each moving with a velocity of 30 ms^{-1}, cross each other. One of the trains gives a whistle whose frequency is 600 Hz. If the speed of sound is 330 ms^{-1}, the apparent frequency for passengers sitting in the other train before crossing would be

A. 600 Hz

B. 630 Hz

C. 930 Hz

D. 720 Hz

Watch Video Solution

194. A person P is 600 m away from the station. When train is approaching station with 72 km/h, it blows a whistle of frequency 800 Hz when 800 m away from the station. Find the frequency heard by the person. Speed of sound = 340 ms^{-1}.

A. 800 Hz

B. 839.5 Hz

C. 829.5 Hz

D. 843.5 Hz

Watch Video Solution

195. A body is moving forwards and backward. Change in frequency observed of source is 2%. What is velocity of the body ? (Speed of sound is 300 m/s)

A. 6 m/s

B. 2 m/s

C. 2.5 m/s

D. 3 m/s

Watch Video Solution

196. A car sounding its horn at $480Hz$ moves towards a high wall at a speed of $20ms^{-1}$, the frequency of the reflected sound heard by the man sitting in the car will be nearest to , (speed of sound $= 330m/s$)

A. 480 Hz

B. 510 Hz

C. 540 Hz

D. 570 Hz

Watch Video Solution

197. A racing car moving towards a cliff, sounds its horn. The driver observes that the sound reflected from the cliff has a pitch one octave higher than the actual sound of the horn. If v is the velocity of sound, then the velocity of the car is

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

B. v/2

C. v/3

D. v/4

Watch Video Solution

198. The loudness and the pitch of a sound depends on

A. speed

B. amplitude

C. frequency

D. wavelength

Watch Video Solution

199. Which of the following has highest pitch in their sound ?

A. Lion

B. Mosquite

C. Man

D. Woman

Watch Video Solution

200. The loudness and the pitch of a sound depends on

A. intensity and frequency

B. frequency and number of harmonics

C. intensity and velocity

D. frequency and velocity

Watch Video Solution

201. Which is different from others by units ?

A. phase difference

B. mechanical equivalent

C. loudness of sound

D. poisson's ratio

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202. What is reverberation ? How can it be reduced ?

A. temperature

B. size of window

C. volume of room

D. changing carpet

Watch Video Solution

203. The longitudinal wave can be observed in

A. elastic media

B. inelastic media

C. both (a) and (b)

D. none of these

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204. The two waves of same frequency moving in the same direction give rise to

A. beats

B. interference

C. stationary waves

D. none of these

Watch Video Solution

205. If the intensity is increased by a factor of 20, by how many decibels is the intensity level increased.

A. 13 dB

B. 7 dB

C. 19 dB

D. 27 dB

Watch Video Solution

206. The average of power transmitted through a given point on a string supporting sine wave is 0.2 W, while the amplitude of wave is $2 \times 10^{-3} m$. If the amplitude of wave is $3 \times 10^{-3} m$ then average power transmitted will be

A. 0.45 W

B. 1.32 W

C. 0.66 W

D. 0.22 W

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207. In a wave both______ and_______ propagate from one point to another but there no motion of_______ as whole through a medium.

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208. Which is most fundamental property of a wave?

Watch Video Solution

209. Which properties of a medium are responsible for propagation of wave through it ?

Watch Video Solution

210. What are pressure waves?

Watch Video Solution

211. When the wire of a sonometer is plucked, the waves produced in the string are______ and that in the air are_______

Watch Video Solution

212. The number of waves contained in unit length of the medium is called

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213. The speed of a traverse wave through a string depends on_______ and _______of the string and not on the _______of the wave.

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214. Sound wave is a________ wave and light wave is a________ wave.

Watch Video Solution

215. Why does sound travel faster in solids than in gases?

Watch Video Solution

216. For a perfectly rigid body

Watch Video Solution

217. In deriving Newton's formula for the velocity of sound, the changes in volume of air are assumed to be _______

Watch Video Solution

218. The pressure and volume changes that take place in a medium through which sound waves travel are_______ in nature.

A. in nature

B.

C.

D.

Watch Video Solution

219. The velocity of sound in a gas is proportional to

Watch Video Solution

220. If the pressure of a gas at constant temperature is increased four times, the velocity of sound in the gas will _______

Watch Video Solution

221. The velocity of sound in a gas is proportional to

Watch Video Solution

222. Why dry air is heavier than moist air?

Watch Video Solution

223. The velocity of sound in air increases by________ for every 1^{O} C rise of temperature.

Watch Video Solution

224. Speed of sound waves in air

Watch Video Solution

225. What is the minimum distance between two points in a wave having a phase difference 2π ?

Watch Video Solution

226. The velocity of sound in a gas at STP is 330 ms^{-1} if the temprature of the gas is increased to 819^o C, the velocity of sound will be ________

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227. Velocity of sound in a tube containing air at 27°C and at a pressure of 76 cm of Hg is 300 m/s. What will its velocity be when the pressure is increased to 100 cm of Hg and the temperature is keptconstant ?

Watch Video Solution

228. The equation y = 0.05 sin2π(0.1x - 2t) represents a wave in which the distances are in metres and time in seconds, the wave speed is________ ms^{-1}.

Watch Video Solution

229. Equation $y = y_0 \sin(Kx + \omega t)$ represents a wave :-

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230. A body vibrating with a certain frequency sends waves of wavelength 15 cm in a medium A and 20 cm in medium B. If $\vee$ of waves in A is $120 ms^{-1}$. That in B will be

Watch Video Solution

231. 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 ....

Watch Video Solution

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

Watch Video Solution

233. If the splash is hear 4.23 seconds after a stone is dropped into a well, 78.4 metres deep, find the velocity of sound in air.

Watch Video Solution

234. Two waves are given by $y_1 = a\sin(\omega t - kx)$ and $y_2 = a\cos(\omega t - kx)$. The phase difference between the two waves is -

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235. Two waves travelling in mutually opposite direction in a medium superimpose over each other, then which event is observed -

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236. When sound is reflected from a denser medium,

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237. When light wave travel from one transparent medium into another , the characteristics with undergo change are

Watch Video Solution

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

Watch Video Solution

239. The distance between any two successive nodes or antinodes in stationary waves is

Watch Video Solution

240. In stationary waves all particles between two nodes pass through the mean position

Watch Video Solution

241. The length of a string tied between two rigid supports is 50 cm. The maximum wavelength of a stationary wave produced on it is

Watch Video Solution

242. In a stationary wave of wavelength 0.4 m, the distance between node and adjacent antinode is _______.

Watch Video Solution

243. When a stretched string of length L vibrating in a particular mode, the distance between two nodes on the string is l. The sound produced in this mode of vibration constitutes the nth overtone of the fundamental frequency of the string.

Watch Video Solution

244. A sound wave travels with a speed of $330ms^{-1}$ in air. If the wavelength of the wave is 330 cm, then the frequency of the wave is ______

Watch Video Solution

245. The tension in a sonometer wire is increased to nine times. Then the fundamental frequency of the wire is

Watch Video Solution

246. A 1 cm long string vibrates with fundamental frequency of 256 Hz . If the length is reduced to $\frac{1}{4}$ cm keeping the tension unaltered, the new fundamental frequency will be

Watch Video Solution

247. A resonance air column of length 20 cm resonates with a tuning fork of frequency 250 Hz . The speed of sound in air is

Watch Video Solution

248. Second overtone of a closed pipe of length , 1m is in unison with third overtone of an open pipe , then the length of the open pipe will be

Watch Video Solution

249. The fundamental frequency of an open and closed organ pipe of the same length is in the ratio

Watch Video Solution

250. The frequency of fundamental mode of vibration of an air column enclosed in a closed end pipe is 250 Hz. If its length is 33 cm , find the velocity of sound in air.

Watch Video Solution

251. The fundamental frequency of a closed organ pipe is same as the first overtone frequency of an open pipe. If the length of open pipe is $50cm$, the length of closed pipe is

Watch Video Solution

252. In an open organ pipe, both odd and even harmonics are present while in a closed organ pipe,_______ harmonics are missing.

Watch Video Solution

253. If the temperature of air in an air column is decreased, then its fundamental frequency will________.

Watch Video Solution

254. Fifth overtone of closed organ pipe is in unison with fifth overtone of open organ pipe. The ratio of their lengths is

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255. If the frequency of two sources of sound are 512 Hz and 516 Hz then the time interval between two consecutive beats produced by sounding them together will be

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256. The waves of wavelengths 1 m and 1.01 m produce 24 beats in 6 s in a gas. The speed of sound in the gas is ________.

Watch Video Solution

257. A tuning fork of unknown frequency when sounded with another tuning fork of frequency 256 Hz produces 4 beats per second, and on loading with a little amount of wax, it again produces 4 beats per second. The unknown frequency is_________.

Watch Video Solution

258. An observer moving towards a stationary source observes that the apparent frequency is three times the actual frequency of the source. If the velocity of sound is V, the velocity of the observer would be-

Watch Video Solution

259. Does the change in frequency due to Doppler effect depend on (i) distance between source and observer? (ii) the fact that source is moving towards observer or observer is moving towards the source?

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260. The motion of the __________brings about a change in the wavelength and observed frequency of sound waves.

Watch Video Solution

261. Can transverse waves be produced in air ?

Watch Video Solution

262. Why do we see lighting before we hear the thunder ?

Watch Video Solution

263. A wave is represented by the equation $y = 0.5 \sin(10t - x)m$. It is a travelling wave propagating along the + x direction with velocity

Watch Video Solution

264. Sound travels faster on a rainy day than on a dry day. Why?

Watch Video Solution

265. (True/False): It is possible to detect the approaching of a distant train by placing the ear very close to the railway line.

Watch Video Solution

266. Explain why (or how) : (a) In a sound wave, a displacement node is a pressure antinode and vice-versa,

(b) Bats can ascertain distances, directions, nature and size of obstacles without any eyes,

(c) a violin note and sitar note may have the same frequency, yet we can distinguish between the two notes, (d) Solids can support both longitudinal and transverse waves, but only longitudinal waves can propagate in gases,

(e) The shape of pulse gets distorted during propagation in a dispersive medium.

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267. Is it necessary for production of beats that the two waves must have exactly equal amplitudes?

Watch Video Solution

268. (True/False): Beats can be heared with sound sources having a frequency difference of 20 Hz.

Watch Video Solution

269. (True/False): A balloon is filled with hydrogen gas. For sound waves it acts as a convex lens.

Watch Video Solution

270. A source of sound with frequency $256 Hz$ is moving with a velocity V towards a wall and an observer is stationary between the source and the wall. When the observer is between the source and the wall he will hear beats.

Watch Video Solution

271. All harmonics are overtones but all overtones are not harmonics . Explain .

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272. engine as heard by an observer, when the engine moves towards the observer with aspeed , is n. If the engine is stationary and the observer moves towards the engine with the same speed v,, the apparent frequency of the same whistle will be :

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273. Assertion : Beats can also be observed by two light sourcesas in sound.

Reason : Light sources have constant phase deference.

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274. Statement-1 : In the case of a stationary wave, a person hear a loud sound at the nodes as compared to the antinodes

Statement-2 : In a stationary wave all the particles of the medium vibrate in phase.

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275. Explain what is meant by wave motion.

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276. MECHANICAL WAVES

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277. What do mechanical waves transfer : energy, matter, both or neither ?

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278. The equation of a simple harmonic progressive wave is $y = 4A \sin 20\pi\left(t - \frac{x}{60}\right)$ with all quantities in SI units. find speed of the wave ?

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279. What is the common velocity of all electromagnetic waves ?

Watch Video Solution

280. The speed of electromagnetic wave in vacuum

Watch Video Solution

281. A simple harmonic progressive wave is given by the equation, $y = 0.8 \sin 4\pi(50t - 0.2x)$ in SI units. Find the wavelength, period, amplitude and speed of the wave.

Watch Video Solution

282. The angle between particle velocity and wave velocity in transverse wave is

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283. What is the angle between particle velocity and wave velocity in (i) transverse waves (ii) longitudinal waves?

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284. In which type of media, solids, liquids, gases is longitudinal wave motion possible?

Watch Video Solution

285. In which type of media, solids, liquids, gases is transverse wave motion possible?

Watch Video Solution

286. In which type of media, solids, liquids, gases is longitudinal wave motion possible?

Watch Video Solution

287. The nature of sound waves in gases is

Watch Video Solution

288. Among reflection, refraction, diffraction, interference and polarization, which is the sole characteristic of transverse waves ?

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289. When the wire of a sonometer is plucked, what is the nature of waves (i) in the string (ii) in air?

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290. When the wire of a sonometer is plucked, what is the nature of waves (i) in the string (ii) in air?

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291. What is the minimum distance between two points in a wave having a phase difference 2π ?

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292. What is the phase difference between two successive crests in the wave

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293. A harmonic wave travelling in a medium has a period T and wavelength X. How are X and T related ?

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294. A harmonic wave travelling in a medium has a period T and wavelength X. How far does the wave travel in time T ?

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295. Obtain a relation between speed, frequency and wavelength of a wave.

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296. The time period of a vibrating source of sound is 0.01s. If speed of sound is $330m/s$, what is the wavelength?

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297. The density of oxygen is 16 times the density of hydrogen. What is the relation between the speeds of sound in two gases?

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298. What is audible range ?

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299. What is the wavelength range of audible sound and visible light ?

Watch Video Solution

300. What is the effect of pressure on speed of sound in air?

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301. How does velocity of sound in air change when temperature rises by $1^\circ C$?

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302. Can mechanical waves travel through vacuum ?

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303. Draw a graph between the pressure of a gas and the speed of sound waves passing through that gas.

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304. Does a vibrating body always produce sound?

Watch Video Solution

305. How far the consecutive nodes are separated from each other ?

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306. What is the distance between a node and a consecutive antinode ?

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307. What is the phase difference between particles being on either side of a node?

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308. What will be the effect on the frequency of a sonometer wire if the tension is decreased by 2% ?

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309. What is the minimum frequency with which a string of length L stretched under tension T can vibrate ?

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310. Fundamental frequency of oscillation of a close pipe is 400 Hz. What will be the fundamental frequency of oscillation of an open pipe of same length ?

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311. The fundamental frequency of an open organ pipe is 512 Hz. What will be its fundamental frequency if its one end is closed ?

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312. The frequency of the first overtone of a closed organ pipe is same as that of first overtone of an open organ pipe. What is the ration of their lengths?

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313. The frequency of the first overtone of a closed organ pipe is same as that of first overtone of an open organ pipe. What is the ration of their lengths?

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314. An organ pipe produces a fundamental frequency of 128 Hz. When blown forcefully, it produces first overtone of 384 Hz. Is the pipe open or dosed ?

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315. How will the fundamental frequency of a closed organ pipe be affected if instead of air, it is filled with a gas heavier than air?

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316. In an open organ pipe, third harmonic has a frequency 450Hz. What is the frequency of fifth harmonic ?

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317. What is the main difference between a flute and a violin?

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318. Where to pluck and where to touch a stretched string to excite its first overtone ?

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319. What is the beat frequency, when two waves of frequency 450 Hz and 456 Hz are superimposed?

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320. What is the essential condition for the formation of beats?

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321. Two sound sources produce 12 beats in 4 seconds. By how much do their frequencies differ?

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322. What is the exact speed of light in vacuum ?

Watch Video Solution

323. name any one use of the phenomenon of beats.

Watch Video Solution

324. State the principle of superposition of waves.

Watch Video Solution

325. State the factors on which the speed of a wave travelling along a stretched ideal string depends.

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326. What are harmonics?

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327. DOPPLER EFFECT

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328. Velocity of sound in air at NTP is 332 m/s. What will be the velocity, when pressure is doubled and temperature is kept constant?

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329. Name any two instruments based on superposition of waves.

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330. Two sounds of very close frequencies, say 256 Hz and 260 Hz are produced simultaneously. What is the frequency of resultant sound and also write the number of beats heard in one second?

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331. The frequencies of two tuning forks A and B are 250 Hz and 255 Hz respectively. Both are sounded together. How many beats will be heard in 5 seconds ?

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332. If tension of a wire is increased to four times, how is the wave speed changed?

Watch Video Solution

333. For an open organ pipe of length l the wavelength of the fundamental note is equal to-

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334. By how much does the speed of sound increase with rise of temperature ?

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335. Distinguish between transverse and longitudinal wave motion.

Watch Video Solution

336. Which properties of a medium are responsible for propagation of wave through it ?

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337. Through what type of media, can () transverse waves be transmitted ? Explain.

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338. Through what type of media, can longitudinal waves be transmitted ? Explain.

Watch Video Solution

339. State if the motion is transverse, longitudinal or a combination of both. Motion of a kink in a long coil spring produced by displacing one end of the spring sideways.

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340. State if the motion is transverse, longitudinal or a combination of both. Wave produced in a cylinder containing water by moving its piston back and forth.

Watch Video Solution

341. State if the motion is transverse, longitudinal or a combination of both. Wave produced by a motorboat sailing in water.

Watch Video Solution

342. State if the motion is transverse, longitudinal or a combination of both. Ultrasonic waves in air produced by a vibrating quartz crystal.

Watch Video Solution

343. Obtain a relation between speed, frequency and wavelength of a wave.

Watch Video Solution

344. On the basis of dimensional considerations, write the formula for the speed of transverse waves on a stretched string.

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345. On the basis of dimentional considerations,write the formula for the speed of transverse waves in a solid.

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346. What is Laplace correction ? Explain by deriving a suitable expression.

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347. Write Newton-Laplace equation for the speed of sound in air. Name two factors which affect the speed of sound in air.

Watch Video Solution

348. Discuss the effect of temperature and density on the velocity of sound in air.

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349. Show that the speed of sound increases by 61 cm/s for every degree rise of temperature.

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350. वायु में ध्वनि की चाल पर ताप वृद्धि का क्या प्रभाव पड़ता है?

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351. What is the effect of amplitude, on the speed of sound in air ?

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352. Why does sound travel faster in moist air than in dry air ?

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353. What is the effect of pressure on speed of sound in air?

Watch Video Solution

354. What is the nature of sound waves in air ? How is the speed of sound waves in atmosphere affected by the humidity?

Watch Video Solution

355. What is the nature of sound waves in air ? How is the speed of sound waves in atmosphere affected by the temperature?

Watch Video Solution

356. Distinguish between transverse and longitudinal wave motion.

Watch Video Solution

357. The equation $y = a \sin 2\pi / \lambda(vt - x)$ is expression for :-

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358. If V is the velocity of the wave and ω is the angular velocity then the propagation constant (K) of the wave is given by

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359. State and illustrate the principle of superposition of waves.

Watch Video Solution

360. What are stationary waves ? State the necessary condition for the formation of stationary waves.

Watch Video Solution

361. CHARACTERISTICS OF STATIONARY WAVES

Watch Video Solution

362. State and explain the laws of vibrations of stretched strings.

Watch Video Solution

363. Diagrammatically show first two modes of vibrations in case of an open organ pipe and write the ratio of their frequencies

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364. Explain how the phenomenon of beats may be used for finding the unknown frequency of a tuning fork.

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365. Bats have no eyes, still they travel during night. Explain, why ?

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366. Define the term wave motion. Give four important characteristics of wave motion.

Watch Video Solution

367. What are mechanical, electromagnetic and matter waves ? Give an example of each type.

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368. Write Newton's formula for the speed of sound in air. What was wrong with this formula ? What correction was made by Laplace in this formula ?

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369. The speed of longitudinal waves 'v' in a given medium of density p is given by the formula $v=\sqrt{\lambda\frac{P}{\rho}}$ Use this formula to explain why the speed of sound in air increases with temperature.

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370. Use the formula $v=\sqrt{\frac{\gamma P}{\rho}}$ to explain why the speed of sound in air

(a) is independent of pressure, (b) increases with temperature, (c) increases with humidity.

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371. What do you mean by phase of a wave ? Discuss the phase change with time. Hence define time period and wavelength of a wave.

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372. Considering suitable examples, discuss the phase change when a wave is reflected from a rigid boundary.

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373. Considering suitable examples, discuss the phase change when a wave is reflected from a free or open boundary.

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374. Give two difference between progressive wave and stationary wave.

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375. Show that in a closed end organ pipe the first three harmonics are in the ratio of 1 : 3 : 5.

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376. Prove analytically that in the case of a closed organ pipe of length L the frequencies of the vibrating air column are given by $v = (2n+1)(v/4L)$, where n is an integer.

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377. Derive an expression for the nth mode of vibration in case of a closed end organ pipe. Hence give the value of $v_1 : v_2 : v_3$.

Watch Video Solution

378. Prove analytically that in the case of an open organ pipe of length L the frequencies of vibrating air column are given by $v = n(v/2L)$, where n is an integer.

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379. Discuss various modes of vibration in open ends organ pipe. Also, show that the ratio of frequencies of different harmonics with first harmonic in open pipe is 1:2:3.

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380. Show that in open organ pipe, all harmonics are present.

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381. On the basis of spring model, explain the propagation of a sound in air.

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382. On the basis of spring model, explain the propagation of a sound in solids.

Watch Video Solution

383. In reference to a wave motion ,define the term amplitude

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384. In reference to a wave motion, define the term time period

Watch Video Solution

385. In reference to a wave motion ,define the term frequency

Watch Video Solution

386. In reference to a wave motion, define the term angular frequency

Watch Video Solution

387. In reference to a wave motion, define the term wavelength

Watch Video Solution

388. In reference to a wave motion, define the term wave number

Watch Video Solution

389. Define wave length , frequency and wave number. How is frequency related to wave number ?

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390. Define velocity of wave motion. Give the expression wave velocity.

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391. Write Newton's formula for the speed of sound in gases. Why and what correction was applied by Laplace in this formula ? Also deduce modified formula for speed of sound.

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392. Why Newton's formula for speed of sound in gas fails? What is Laplace's correction? Write Newton Laplace formula for speed of sound in gas.

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393. In a simple harmonic progressive wave, the maximum particle velocity is twice the wave velocity. If λ is the wavelength, then its amplitude is given by

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394. For a particle executing simple harmonic motion, the acceleration is proportional to

Watch Video Solution

395. What are stationary waves?

Watch Video Solution

396. Derive an expression for the instantaneous acceleration of a particle executing S.H.M. Find the position where acceleration is maximum and where it is minimum.

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397. Two superimposig waves are represented by equation $y_1 = 2\sin 2\pi(10t - 0.4x)$ and $y_2 = 4\sin 2\pi(20t - 0.8x)$. The ratio of $l_{\max}$ to $l_{\min}$ is

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398. Give analytical treatment of formation of standing waves on strings and discuss briefly the normal modes of vibration of strings.

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399. Discuss the formation of harmonics in a stretched string. Show that in case of a stretched string the first four harmonics are in the ratio 1 : 2 : 3 : 4.

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400. Attempt any THREE :

Show that beats frequency is equal to frequency difference between two interfering waves.

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401. The number of beats produced per second is equal to the –

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402. Draw the fundamental modes of vibration of stationary waves in : Closed pipe.

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403. Draw the fundamental modes of vibration of stationary waves in : An open pipe.

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404. DOPPLER EFFECT

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405. A source of frequency n is moving with a uniform velocity v towards a stationary observer. If the velocity of sound is V, then the change in frequency would be -

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406. A policeman on duty detects a drop detects a drop of 15% in the pitch of the horn of a motor car as it crossed him. If the velocity of sound is $330 metre/\sec.$, calculate speed of the car.

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

A. 200 Hz

B. 3000 Hz

C. 120 Hz

D. 600 Hz

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

A. $\sqrt{2/7}$

B. $\sqrt{1/7}$

C. $\sqrt{3}/5$

D. $\sqrt{6}/5$

409. Two monoatomic ideal gases 1 and 2 of molecular masses m^1 and m^2 respectively are enclosed in separate containers kept at the same temperature. The ratio of the speed of sound in gas 1 to that in gas 2 is given by :-

A. $\sqrt{\frac{M_1}{M_2}}$

B. $\sqrt{\frac{M_2}{M_1}}$

C. $\frac{M_1}{M_2}$

D. $\frac{M_2}{M_1}$

410. 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.SOv

D. 0.75v

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411. A travelling wave in a stretched string is described by the equation $y = A \sin(kx - \omega t)$ the maximum particle velocity is

A. $A\omega$

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

C. $d\omega / dk$

D. x / t

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

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

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

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

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

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413. 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 strings vibrate in their fundamental modes, the one of length L with frequency n_1 and the other with frequency n_2 the ratio n_1 / n_2 is given by

A. 2

B. 4

C. 8

D. 1

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414. A sonometer wire resonates with a given tuning fork forming a standing wave with five antinodes between the two bridges when a mass of $9kg$ is suspended from the wire. When this mass is replaced by a mass 'M' kg, the wire resonates with the same tuning fork forming three antinodes for the same positions of the bridges. Find the value of M.

A. 25 kg

B. 5 kg

C. 12.5 kg

D. $(1/25)kg$

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

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

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

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

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

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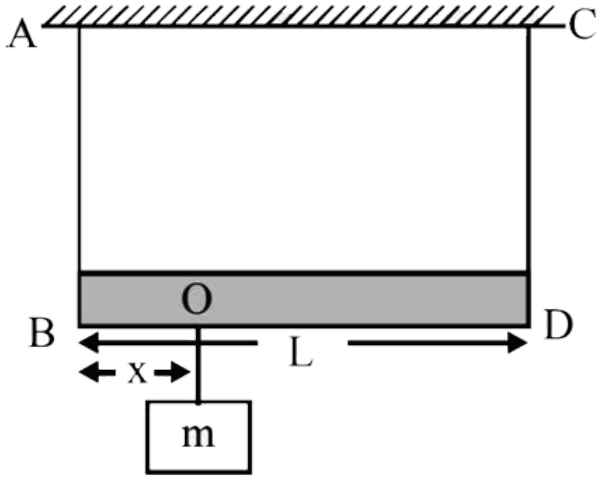
416. A massless rod of length L is suspened by two identical string AB and CD of equal length. A block of mass m is suspended from point O such that BO is equal to 'x'. Further it is observed that the frequency of $1st$ harmonic in AB is equal to $2nd$ harmonic frequency in CD. 'x' is



A. $\frac{L}{5}$

B. $4\frac{L}{5}$

C. $3\frac{L}{5}$

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

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417. In the experiment to determine the speed of sound using a resonance column,

A. prongs of the tuning fork are kept in a vertical plane

B. prongs of the tuning fork are kept in a horizontal plane

C. in one of the two resonances observed, the length of the resonating air column is close to the wavelength of sound in air

D. in one of the two resonances observed, the length of the resonating air column is close to half of the wavelength of sound in air

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418. An open pipe is in resonance in $2nd$ harmonic with frequency f_1. Now one end of the tube is closed and frequency is increased to f_2

such that the resonance again ocuurs in nth harmonic. Choose the correct option

A. $n = 3, f_2 = \left(\frac{3}{4}\right) f_1$

B. $n = 3, f_2 = \left(\frac{5}{4}\right) f_1$

C. $n = 5, f_2 = \left(\frac{3}{4}\right) f_1$

D. $n = 5, f_2 = \left(\frac{5}{4}\right) f_1$

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419. In a resonance tube with tuning fork of frequency $512Hz$, first resonance occurs at water level equal to $30.3cm$ and second resonance ocuurs at $63.7cm$. The maximum possible error in the speed of sound is

A. $51.2cm / s$

B. $102.4m / s$

C. $204.8cm / s$

D. $153.6cm / s$

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420. 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 $100Hz$ 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

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421. In the experiment for the determination of the speed of sound in air using the resonance column method, the length of the air column that resonates in the fundamental mode, with a tuning fork is $0.1m$. When this length is changed to $0.35m$, the same tuning fork resonates with the first overtone. Calculate the end correction.

A. 0.012 m

B. 0.025 m

C. 0.05 m

D. 0.024 m

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422. Two plane harmonic sound waves are expressed by the equations.

$y_1(x, t) = A\cos(\pi x - 100\pi t)$

$y_2(x, t) = A\cos(0.46\pi x - 92\pi t)$

(All parameters are in MKS)

How many times does an observer hear maximum intensity in one second?(At x = 0)

A. 4

B. 6

C. 8

D. 10

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423. A vibrating string of certain length l under a tension T resonates with a mode corresponding to the first overtone (third harmonic) of an air column of length $75cm$ inside a tube closed at one end. The string also generates 4 beats per second when excited along with a tuning fork of frequency n. Now when the tension of the string is slightly increased the number of beats reduces 2 per second. Assuming the velocity of sound in air to be $340m/s$, the frequency n of the tuning fork in Hz is

A. 344

B. 336

C. 117.3

D. 109.3

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424. A hollow pipe of length $0.8m$ is closed at one end. At its open end a $0.5m$ long uniform string is vibrating in its second harmonic and it resonates with the fundamental frequency of the pipe. If the tension in the wire is $50N$ and the speed of sound is $320ms^{-1}$, the mass of the string is

A. 5 grams

B. 10 grams

C. 20 grams

D. 40 grams

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425. A student is performing the experiment of resonance column. The diameter of the column tube is $4cm$. The frequency of the tuning fork is $512Hz$ The air temperature is $38.^\circ C$ in which the speed of sound is $336m/s$. The zero of the meter scale coincides with the top end of the resonance column tube. When the first resonance occurs, the reading of the water level in the column is.

(a) $14.0cm$

(b) $15.2cm$

(c) $6.4cm$ (d) $17.6cm$.

A. 14.0 cm

B. 15.2 cm

C. 16.4 cm

D. 17.6 cm

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426. A whistle giving out $450H_Z$ approaches a stationary observer at a speed of $33m/s$. The frequency heard the observer (in H_Z) is (speed of sound $= 330m/s$)

A. 409

B. 429

C. 517

D. 500

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427. A train moves towards a stationary observer with speed $34m/s$. The train sounds a whistle and its frequency registered by the observer is f_1. If the train's speed is reduced to $17m/s$, the frequency registered is f_2. If the speed of sound of $340m/s$, then the ratio $f_1/f_2$is

A. $\frac{18}{19}$

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

C. 2

D. $\frac{19}{18}$

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428. A siren placed at a railway platform is emitting sound of frequency $5kHz$. A passenger sitting in a moving train A records a frequency of $5.5kHz$ while the train approaches the siren. During his return journey in a different train B he records a frequency of $6.0kHz$ while approaching the same siren. the ratio the velocity of train B to that of train A is

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

B. 2

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

D. $\frac{11}{6}$

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429. A police car with a siren of frequency $8KHz$ is moving with uniform velocity $36Km/hr$ towards a ball building which reflects the sound waves. The speed of sound in air is $320 m/s$. The frequency of the siren heard by the car driver is

A. 8.50 kHz

B. 8.25 kHz

C. 7.75 kHz

D. 7.50 kHz

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

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

B. of wavelength πm

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

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

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431. A wave is represented by the equation

$$y = A\sin\left(10\pi x + 15\pi t + \frac{\pi}{3}\right)$$

where x is in meter and t is in seconds. The expression represents :

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

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

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

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

0.2 m

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

A. electric field

B. magnetic field

C. displacement

D. pressure

Watch Video Solution

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

A. pulse is moving in + x direction

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

C. its maximum displacement is 0.16 m

D. it is a symmetric pulse

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434. A transverse sinusoidal wave of amplitude a, wavelength λ and frequency f is travelling on a stretched string. The maximum speed of any point in the string is $v/10$, where v is the speed of propagation of the wave. If $a = 10^{-3}m$ and $v = 10ms^{-1}$, then λ and f are given by

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

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

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

D. $f = 10^{4} Hz$

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435. As a wave propagates,

A. the wave intensity remains constant for a plane wave

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

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

D. t0tal intensity of the spherical wave over the spherical surface centered at the source remains constant at all time

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436. Standing waves can be produced

A. on a string clamped at both the ends

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

C. when incident wave gets reflected from a wall

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

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437. An air column in pipe, which is closed at one end, will be in resonance with a vibrating tuning fork of frequency $264Hz$ if the length of the column in cm is :

A. 31.25

B. 62.5

C. 93.75

D. 125

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438. A tube, closed at one end and containing air, produces, when excited, the fundamental note of frequency $512Hz$. If the tube is open at both ands the fundamental frequency that can be excited is (in Hz)

A. 1024

B. 512

C. 256

D. 128

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439. A student performed the experiment to measure the speed of sound in air using resonance air-column method. Two resonances in the air-column were obtained by lowering the water level. The resonance with the shorter air-column is the first resonance and that with the longer air-column is the second resonance. Then,

A. the intensity of the sound heard at the first resonance was more than that at the second resonance

B. the prongs of the tuning fork were kept in a horizontal plane above the resonance tube

C. the amplitude of the vibration of the ends of the prongs is typically around 1 cm

D. the length of air-column at the first resonance was somewhat shorter than $1/4$th of the wavelength of the sound in air

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

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

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

C. $\frac{1}{6}$

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

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441. Velocity of sound in air is $320ms^{-1}$. A pipe closed at one end has a length of 1 m. Neglecting end correction, the air column in the pipe cannot resonate with sound of frequency

A. 80 Hz

B. 240 Hz

C. 320 Hz

D. 400 Hz

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442. A string of length $0.4m$ and mass $10^{-2}kg$ is tightly clamped at its ends. The tension in the string is $1.6N$. Identical wave pulse are produced at one end at equal intervals of time, Δt. The minimum value of Δt which allows constructive interference of successive pulse is

A. 0.05 s

B. O.lO 1s

C. 0.20 s

D. Oo40 s

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443. Two idential straight wires are stretched so as to produce 6 beats per second when vibrating simultaneously. On changing the tension slightly in one of them, the beat frequency remains unchanged. Denoting by T_1, T_2 the higher and the lower initial tension in the strings, then it could be said that while making the above changes in tension,

A. T_2 was decreased

B. T_2 was increased

C. T_1 was decreased

D. T_1 was increased

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444. 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

B. three

C. four

D. five

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445. A wave disturbance in a medium is described by $y(x,t) = 0.02\cos\left(50\pi t + \frac{\pi}{2}\right)\cos(10\pi x)$ where x and y are in meter and t is in second`

A. A node occurs at x = 0.15 m

B. An antinode occurs at x = 0.3 m

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

D. The wavelength is 0.2 m

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

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

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

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

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

447. One end of a taut string of length 3m along the x axis is fixed at x = 0. The speed of the waves in the string is $100ms^{-1}$. The other end of the string is vibrating in the direction so that stationary waves are set up in the string. the possible waveform of these stationary waves is (are)

A. $y(t) = A\sin\left(\pi\frac{x}{6}\right)\cos\left(5\pi\frac{t}{3}\right)$

B. $y(t) = A\sin\left(\pi\frac{x}{3}\right)\cos\left(100\pi\frac{t}{3}\right)$

C. $y(t) = A\sin\left(5\pi\frac{x}{6}\right)\cos\left(250\pi\frac{t}{3}\right)$

D. $y(t) = A\sin\left(5\pi\frac{x}{2}\right)\cos 250\pi t$

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448. A person blows into open- end of a long pipe. As a result,a high pressure pulse of air travel down the pipe. When this pulse reaches the other end of the pipe,

A. a high-pressure pulse starts travelling up the pipe, if the other end of the pipe is open.

B. a low-pressure pulse starts travelling up the pipe, if the other end of the pipe is open.

C. a low-pressure pulse starts travelling up the pipe, if the other end of the pipe is closed.

D. a high-pressure pulse starts travelling up the pipe, if the other end of the pipe is closed

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449. A horizontal stretched string, fixed at two ends, is vibrating in its fifth harmonic according to the equation, $y(x, t) = (0.01m)\sin\left[\left(62.8m^{-1}x\right]\cos\left[\left(628s^{-1}\right)t\right]$. Assuming $p = 3.14$, the correct statement(s) is (are)

A. The number of nodes is 5

B. The length of the string is 0.25 m

C. The maximum displacement of the midpoint of the string, from its equilibrium position, is 0.01 m

D. The fundamental frequency is 100 Hz

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

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

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

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

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

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

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

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

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

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451. Two vehicles, each moving with speed u on the same horizontal straight road, are approaching each other. Wind blows along the road with velocity w. One of these vehicles blows a whistle of frequency f_1. An observer in the other vehicle hears the frequency of the whistle to be f_2. the speed of sound in still air is V_C. The correct statement (s) is (are)

A. If the wind blows from the observer to the source, $f_2 > f_1$

B. If the wind blows from the source to the observer, $f_2 > f_1$

C. If the wind blows from observer to the source, f_2 lt f_1`

D. If the wind blows from the source to the observer, $f_2 < f_1$

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452. In an experiment to measure the speed of sound by a resonating air column, a tuning fork of frequency 500 Hz is used. The length of the air column is varied by changing the leavel of water in the resonance tube. Two successive resonances are heard at air columns of length 50.7 cm and 83.9 cm. Which of the following statements is (are) true?

A. The speed of sound determined from this experiment is $332ms^{-1}$

B. The end correction in this experiment is 0.9 cm

C. The wavelength of the sound wave is 66.4 cm

D. The resonance at 50.7 cm corresponds to the fundamental harmonic

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453. The disperod of a particle varies according to the relation $x = 4(\cos \pi t + \sin \pi t)$. The amplitude of the particle is.

A. -4

B. 4

C. $4\sqrt{2}$

D. 8

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454. The displacement y of a partcle in a medium can be expressed as, $y = 10^{-6} \sin\left(\left(100t + 20x + \frac{\pi}{4}\right)m\right.$ where t is in second and x in meter. The speed of the wave is

A. $2, 000ms^{-1}$

B. $5ms6 - 1$

C. $20ms^{-1}$

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

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455. 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 moving in $+x$ direction with speed $\sqrt{\frac{a}{b}}$

B. wave moving in $+x$ direction with speed $\sqrt{\frac{b}{a}}$

C. standing wave of frequency $\sqrt{b}$

D. standing wave of frequency $\frac{1}{\sqrt{b}}$

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456. The equation of a wave on a string of linear mass density $0.04 kgm^{-1}$ is given by $y = 0.02(m)\sin\left[2\pi\left(\frac{t}{0.04(s)} - \frac{x}{0.50(m)}\right)\right]$.

The tension in the string is :

A. 6.25 N

B. 4.0 N

C. 12.5 N

D. 0.5 N

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

A. $460ms^{-1}$

B. $500ms^{-1}$

C. $650ms^{-1}$

D. $1420ms^{-1}$

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458. Length of a string tied to two rigid support is $40cm$. Maximum length (wavelength in cm) of a stationary wave produced on it is

A. 20

B. 80

C. 40

D. 120

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459. 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. 1,050 Hz

B. 10.5 Hz

C. 105 Hz

D. 1.05 Hz

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460. A metal wire of linear mass density of $9.8g/m$ is stretched with a tension of $10kg-wt$ between two rigid support $1meter$ 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. 50 Hz

B. 100 Hz

C. 200 Hz

D. 25 Hz

Watch Video Solution

461. Tube A has both ends open while tube B has one closed, otherwise they are identical. The ratio of fundamental frequency of tube A and B is

A. 1 : 2'

B. 1 : 4'

C. 2 : 1'

D. 4 : 1'

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462. When temperature increases, the frequency of a tuning fork

A. increases

B. increases

C. increases or decreases depending on the material

D. remains the same.

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463. A tuning fork arrangement (pair) produces $4beats/\sec$ with one fork of frequency $288cps$. A little wax is placed on the unknown fork and it then produces $2beats/\sec$. The frequency of the unknown fork is

A. 286 cps

B. 292 cps

C. 294 cps

D. 288 cps

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464. When two tuning forks (fork 1 and fork 2) are sounded simultaneously, 4 beats per second are heard. Now, some tape is attached on the prong of fork 2. When the tuning forks are sounded again, 6 beats per second are heard. If the frequency of fork 1 is 200 Hz, then what was the original frequency of fork 2 ?

A. 200 Hz

B. 202 Hz

C. 196 Hz

D. 204 Hz

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465. The waves in which the particles of the medium vibrate in a direction perpendicular to the direction of wave motion is known as

A. transverse waves

B. longitudinal waves

C. propagated waves

D. none of these

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466. The waves produced by a motor boat sailing in water are :

A. transverse

B. longitudinal

C. longitudinal· art transverse

D. stationary

Watch Video Solution

467. For a wave propagating in medium, identify the property that is independent of the others.

A. velocity

B. wavelength

C. frequency

D. all these depend on each other

Watch Video Solution

468. 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. 2,500 s

B. 75 s

C. 4 s

D. 0.25 s

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469. Two waves are represented by the equations $y_1 = a \sin \omega t$ and $y_2 = a \cos \omega t$. The first wave

A. a

B. $\sqrt{2}a$

C. 2a

D. zero

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470. Five sinusoidal waves have the same frequency $500 Hz$ but their amplitudes are in the ratio $2:1/2:1/2:1:1$ and their phase angles $0, \pi/6, \pi/3, \pi/2 \text{ and } \pi$, respectively . The phase angle of resultant wave obtained by the superposition of these five waves is

A. 30°

B. 45°

C. 60°

D. 90°

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471. Energy is not carried by which of the following waves

A. stationary

B. progressive

C. transverse

D. electromagnetic.

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472. 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

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473. If vibrations of a string are to be increased by a factor of two, then tension in the string must be made

A. half

B. twice

C. four times

D. eight times

Watch Video Solution

474. The tension in a piano wire is $10N$. The tension ina piano wire to produce a node of double frequency is

A. 5 N

B. 20 N

C. 40 N

D. 80 N

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475. A string in a musical instrument is 50 cm long and its fundamental frequency is 800 Hz. If a frequency of 1000 Hz is to be produced, then required length of string is

A. 62.5 cm

B. 50 cm

C. 40 cm

D. 37.5 cm

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476. The frequency of tuning fork is 256 Hz. It will not resonate with a fork of frequency

A. 256

B. 512

C. 738

D. 768

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477. A uniform string is vibrating with a fundamental frequency 'f'. The new frequency, if radius & length both are doubled would be

A. 2 f

B. 3 f

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

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

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478. 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. $210ms^{-1}$

B. $40ms^{-1}$

C. $110ms^{-1}$

D. $55ms^{-1}$

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479. An organ pipe is closed at one end has fundamental frequency of 1500 Hz. The maximum number of overtones generated by this pipe which a normal person can hear is

A. 12

B. 9

C. 6

D. 4

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480. A tube, closed at one end and containing air, produces, when excited, the fundamental note of frequency $512Hz$. If the tube is open at both ands the fundamental frequency that can be excited is (in Hz)

A. 256Hz

B. 768Hz

C. 1024Hz

D. 1280hZ

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

A. increases

B. decrease

C. remain the same

D. first (b) then ©

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482. A resonance air column of length 20 cm resonates with a tuning fork of frequency 250 Hz . The speed of sound in air is

A. $720ms^{-1}$

B. $820ms^{-1}$

C. $920ms^{-1}$

D. $360ms^{-1}$

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483. A sings with a frequency n and B sings with a frequency $1/8$ that of A. If the energy remains the same and the amplitude of A is a, then amplitude of B will be

A. a

B. 2a

C. 8a

D. 16a

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484. If fundamental frequency is 50 and next successive frequencies are 150 and 250 then it its

A. a pipe closed at both ends

B. a pipe closed at one end

C. an open pipe

D. a stretched string

485. 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. 8 m

B. 4 m

C. 2 m

D. 1 m

486. A strone thrown into still water, creates a circular wave pattern moving radially outwards. If r is the distance measured from the centre of the pattern. The amplitudeof the aves varies as

A. $r^{-1}/2$

B. r^{-1}

C. $r^{-3}/2$

D. r^{-2}

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487. A siren emitting sound of frequency $800Hz$ is going away from a static listener with a speed of 30 m/s. Frequency of the sound to be heard by the listener is (Take velocity of sound as 300 m/s)

A. 733.3 Hz

B. 644.8 Hz

C. 481.2 Hz

D. 286.5 Hz

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488. A source of sound of frequency 500 Hz is moving towards an observer with velocity 30 m/s . The speed of sound is 330 m/s . the frequency heard by the observer will be

A. 1,990 Hz

B. 2,000 Hz

C. 2,100 Hz

D. 4,000 Hz

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489. A source is moving towards an observer with a speed of 20 m / s and having frequency of 240 Hz . The observer is now moving towards the source with a speed of 20 m / s . Apparent frequency heard by observer, if velocity of sound is 340 m / s , is

A. 240 Hz

B. 270 Hz

C. 330 Hz

D. 360 Hz

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490. A source and an observer are moving towards each other with a speed equal to $\frac{v}{2}$ where v is the speed of sound. The source is emitting sound of frequency n . The frequency heard by the observer will be

A. zero

B. n

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

D. 3n

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491. A wave is represented by the equation $y = 0.5 \sin(10t - x)m$. It is a travelling wave propagating along the + x direction with velocity

A. $10ms^{-1}$

B. $20ms^{-1}$

C. $5ms^{-1}$

D. none of these

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492. A wave packet with angular frequency ω_0 is propagating in dispersive medium with phase velocity of $1.5 \times 10^3 m / s$. When the frequency is increased by 2%, the phase velocity is found to decrease by 3% what is the group velocity of the wave packet?

A. $0.25 \times 10^3 m / s$

B. $1.0 \times 10^3 m / s$

C. $0.6 \times 10^3 m / s$

D. $0.75 \times 10^3 m / s$

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493. When a stretched wire and a tuning fork are sounded together, 5 beats per second are produced, when length of wire is $95cm$ or $100cm$, frequency of the fork is

A. 90 Hz

B. 100 Hz

C. 105 Hz

D. 195 Hz

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494. With the propagation of a longitudinal wave through a material medium, the quantities transmitted in the propagation direction are

A. energy, momentum and mass

B. energy

C. energy and mass

D. energy and linear momentum

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495. Which one of the following statements is true ?

A. both light and sound waves can travel in vacuum

B. both light and sound waves in air are transverse

C. the sound waves in air are longitudinal while the light waves are transverse

D. both light and sound waves in air are longitudinal

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496. the velocity of sound in any gas deponds upon

A. wavelength of sound only

B. density and elasticity of gas

C. intensity of sound waves only

D. amplitude and frequency of sound

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497. A hospital uses an ultrasonic scanner to locate tumours in a tissue. The operating freqency of the scanner is 3.2 MHz. The speed of sound in a tissue is 1.6 km s^{-1}. The wavelength of sound in the tissue is

A. $4 \times 10^{-3} m$

B. $8 \times 10^{-3} m$

C. $4 \times 10^{-4} m$

D. $8 \times 10^{-4} m$

Watch Video Solution

498. 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. $110 ms^{-1}$

B. $165 ms^{-1}$

C. $77 ms^{-1}$

D. $102 ms^{-1}$

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

A. $273^\circ C$

B. $0^\circ C$

C. $927^\circ C$

D. $1027^\circ C$

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500. $4.0g$ of a gas occupies 22.4 litres at NTP. The specific heat capacity of the gas at constant volume is $5.0JK^{-1}mol^{-1}$. If the speed of sound in this gas at NTP is $952ms^{-1}$. Then the heat capacity at constant pressure is

A. $8.5JK^{-1}mol^{-1}$

B. $8.0JK^{-1}mol^{-1}$

C. $7.5JK^{-1}mol^{-1}$

D. $7.0JK^{-1}mol^{-1}$

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501. 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. 165 Hz

B. 150 Hz

C. 660 Hz

D. 330 Hz

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502. Two sound waves having a phase difference of 60° have path difference of

A. $\lambda/6$

B. $\lambda/3$

C. 2λ

D. $\lambda/2$

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503. In a sinusoidal wave, the time required for a particular point to move from maximum displacement to zero displacement is 0.170 second. The frequency of the wave is

A. 0.73 Hz

B. 0.36 Hz

C. 1 .47 Hz

D. 2.94 Hz

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504. Which of the following represents a wave?

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

B. $y = A\cos(at - bx + c)$

C. $y = A\sin kx$

D. $y = A\sin\omega t$

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505. The frequency of the sinusoidal wave

$y = 0.40 \cos[2000t + 0.80x]$ would be

A. $1000\pi Hz$

B. 2000 Hz

C. 20 Hz

D. $\frac{1000}{\pi} Hz$

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506. The equation of a sound wave is $y = 0.0015 \sin(62.4x + 316t)$

the wavelength of this wave is

A. 0.3 unit

B. 0.2 unit

C. 0.1 unit

D. cannot be calculated

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507. 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. $8m/s$

B. $4\pi m/s$

C. $0.5\pi m/s$

D. $\left(\frac{\pi}{4}\right)m/s$

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

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

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

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

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

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510. Two waves having equation's

$x_1 = a\sin(\omega t + \phi_1)$,$x_2 = a\sin(\omega t + \phi_2)$

If in the resultant wave the frequency and amplitude remain equal to those of superimposing waves. Then phase difference between them is

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

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

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

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

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511. Two waves are represented by the equations

$y_1 = a\sin(\omega t + kx + 0.785)$

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

where, x is in meter and t in second

The phase difference between them and resultant amplitude due to their superposition are

A. 1.0 radian

B. 1.25 radian

C. 1.57 radian

D. 0.57 radian

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

B. πA

C. $2\pi A$

D. A

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513. The equations of two waves given as $x = a\cos(\omega t + \delta)$ and $y = a\cos(\omega t + \alpha)$, where $\delta = \alpha + \frac{\pi}{2}$, then resultant wave represent:

A. a parabola

B. a circle

C. an ellipse

D. a straight line

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

A. decreases by a factor 10

B. increases by a factor 20

C. increases by a factor 10

D. decreases by a factor 20

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515. The wave described by y $= 0.25 \sin(10\pi x - 2\pi nt)$ where x and y are in meters and t in seconds , is a wave travelling along the

A. -ve x-direction with frequency 1 Hz

B. $-vex - directionwithequencynHz$ and $wave \leq n > h$

lambda = 0.2 m`

C. +ve x-direction with frequency 1 Hz and wavelength $\lambda = 0.2m$

D. -ve x-direction with amplitude 0.25 m and wavelength $\lambda = 0.2m$

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516. A standing wave is represented by, $y - A\sin(100t)\cos(0.01x)$, where x,y and A are in millimeter and t in second. The velocity of the wave is

A. $10^4 m/s$

B. not derivable

C. $1m/s$

D. $10^2 \frac{m}{s}$

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517. A wave has SHM (simple harmonic motion) whose period is 4s while another periods 3 s. If both are combined, then the resultant wave will have the period equal to

A. 4 sec

B. 5 sec

C. 12 sec

D. 3 sec

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518. 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. 5 Hz

B. 10 Hz

C. 2 Hz

D. 4 Hz

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519. A stretched string resonates with tuning fork of frequency 512 Hz. When length of the string is 0.5 m. the length of the string required to vibrate resonantly with a tuning fork of frequency 256 Hz would be

A. 0.25 m

B. 0.5 m

C. 1 m

D. 2 m

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520. If the tension and diameter of a sonometer wire of fundamental frequency n are doubled and density is halved then its fundamental frequency will become

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

B. $\sqrt{2}n$

C. n

D. $\frac{n}{\sqrt{2}}$

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521. A wave frequency $100Hz$ travels along a string towards its fixed end . When this wave travels back after reflection , a node is formed at a distance of $10cm$from the fixed end . The speed of the wave (incident and reflected) is

A. $20m/s$

B. $40m/s$

C. $5m/s$

D. $10m/s$

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522. The length of a sonometer wire is 1m. Where should be the bridge placed to divide the wire into 2 segments, whose fundamental frequencies are in the ratio $1:2$?

A. 60 cm and 90 cm

B. 30 cm and 60 cm

C. 30 cm and 90 cm

D. 40 cm and 80 cm

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

A. 105 Hz

B. 155 Hz

C. 205 Hz

D. 10.5 Hz

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524. A closed organ pipe (closed at one end) is excited to support the third overtone. It is found that air in the pipe has

A. three nodes and three antinodes

B. three nodes and four antinodes

C. four nodes and three antinodes

D. four nodes and four antinodes

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525. A cylinderical tube open at 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 air column is now

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

B. $3\frac{f}{4}$

C. $2f$

D. f

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

A. Open end will be antinode

B. Odd harmonics of the fundamental frequency will be generated

C. All harmonics of the fundamental frequency will be generated

D. Pressure change will be maximum at both ends

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527. 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. 100 cm

B. 120 cm

C. 140 cm

D. 80 cm

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528. 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. 4

B. 5

C. 7

D. 6

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529. Is it necessary for production of beats that the two waves must have exactly equal amplitudes?

A. different frequencies and same amplitude

B. different frequencies

C. different frequencies, same amplitude and same phase

D. different frequencies and same phase

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

A. 205 Hz

B. 195 Hz

C. 200 Hz

D. 210 Hz

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531. A sources of sound gives 5 beats per second when sounded with another sources of frequency $100 \sec ond^{-1}$. The second harmonic of the source, together with a source of frequency $205 \sec ond^{-1}$ gives 5 beats per second. What is the frequency of the source ?

A. $105 \sec ond^{-1}$

B. $205 \sec ond^{-1}$

C. $95 \sec ond^{-1}$

D. $100 \sec ond^{-1}$

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532. Two waves of length 50 cm and 51 cm produced 12 beas per second. The velocity of sound is :

A. $340 m / s$

B. $331 m / s$

C. $306 m / s$

D. $360 m / s$

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

A. 6

B. 2

C. 0

D. 1

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534. 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. 3

B. 6

C. 7

D. 8

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535. A tuning fork of known frequency $256 Hz$ makes 5 beats per second with the vibrating string of a piano. The beat frequency decreases to 2 beats per second 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

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536. The identical piano wires kept under the same tension T have a fundamental frequency of 600 Hz. The fractional increase in the tension of one of the wires which will lead to occurrence of 6 beats//s when both the wires oscillate together would be

A. 0.04

B. 0.01

C. 0.02

D. 0.03

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537. 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. 254 Hz

B. 246 Hz

C. 240 Hz

D. 260 Hz

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538. Two vibrating tuning forks produce waves given by $y_1 = 4 \sin 500\pi t$ and $y_2 = 2 \sin 506\pi t$. Number of beats produced per minute is :

A. 360

B. 180

C. 60

D. 3

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539. 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. 4 beats per second with intensity ratio 25 : 16 between waxing and waning

B. 8 beats per second with intensity ratio 25 : 16 between waxing and waning

C. 8 beats per second with intensity ratio 81 : 1 between waxing and waning

D. 4 beats per second with intensity ratio 81 : 1 between waxing and waning

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540. 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. 500 Hz

B. 550 Hz

C. 555.5 Hz

D. 720 Hz

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

A. $20m/s$

B. $2m/s$

C. $200m/s$

D. $2000m/s$

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542. A car is moving towards a high cliff. The car driver sounds a horn of frequency f. The reflected sound heard by the driver has a frequency $2f$. if v be the velocity of sound, then the velocity of the car, in the same velocity units, will be

A. $v/\sqrt{2}$

B. $v/3$

C. $v/4$

D. $v/2$

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543. 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. $1.2f, 1.2\lambda$

B. $1.2f, \lambda$

C. $f, 1.2\lambda$

D. $0.8f, 0.8\lambda$

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544. 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. $n_1 = 0.1n$

B. $n_1 = 0$

C. $n_1 = 10n$

D. $n_1 = -0.1n$

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545. 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 $330ms^{-1}$)

A. 3500 Hz

B. 4000 Hz

C. 5000 Hz

D. 3000 Hz

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546. 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. 1332 Hz

B. 1372 Hz

C. 1412 Hz

D. 1454 Hz

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547. The amplitude of sound is doubled and the frequency is reduced to one fourth. The intensity of sound at the same point will be

A. increasing by a factor of 2

B. decreasing by a facto11 of 2

C. decreasing by a factor of 4

D. unchanged

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548. 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. 3:2'

B. 2:3'

C. $9:4$

D. $4:9$

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549. The time of reverberation of a room A is one second. What will be the time (in seconds) of reverberation of room, having all the dimensions double of those of room A?

A. 1

B. 2

C. 4

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

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550. The two nearest harmonics of a tube closed at one end and open at other end are 220 Hz and 260 Hz. What is the fundamental frequency of the system?

A. 10 Hz

B. 20 Hz

C. 30 Hz

D. 40 Hz

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551. Two car moving in opposite directions approach each other with speed of $22m/s$ and $16.5m/s$ respectively. The driver of the first car blows a horn having a frequency $400Hz$. The frequency heard by the driver of the second car is [velocity of sound $340m/s$].

A. 350 Hz

B. 361 Hz

C. 411 Hz

D. 448 Hz

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552. 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. $\sqrt{\frac{m_1}{m_2}}$

B. $\sqrt{\frac{m_1+m_2}{m_2}}$

C. $\sqrt{\frac{m_2}{m_1}}$

D. $\sqrt{\frac{m_1+m_2}{m_2}}$

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553. An air column, closed at one end and open at the other resonates with a tuning fork when the smallest legnth of the column is 50 cm. The next larger length of the column resonating with the same tuning fork is

A. 66.7 cm

B. 100 cm

C. 150 cm

D. 200 cm

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554. 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. 765 Hz

B. 800 Hz

C. 838 Hz

D. 885 Hz

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555. A tuning fork is used to produce resonance in glass tuve. The length of the air column in the tube can be adjusted by a variable piston. At room temperature of $27^\circ C$ two succesive resonance are produced at 20 cm and 73 cm column length. If the frequency of the tuning fork is 320 Hz. the velocity of sound is air at $27^\circ C$ is

A. $330m/s$

B. $300m/s$

C. $350m/s$

D. $339m / s$

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556. 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. $\frac{L}{2}$

B. 4L

C. L

D. 2L

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557. 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

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558. The fundamental frequency in an open organ pipe is equal to the third harmonic of a closed organ pipe. If the length of the closed organ pipe is 20 cm, the length of the open organ pipe is

A. 13.2 cm

B. 16 cm

C. 12.5 cm

D. 8 cm

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