ALLEN CAREER INSTITUTE KOTA (RAJASTHAN)
path to success

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PRE-MEDICAL

PHYSICS

ENTHUSIAST | LEADER | ACHIEVER

EXERCISE

Wave Motion & Doppler's Effect

ENGLISH MEDIUM

EXERCISE-I (Conceptual Questions) Build Up Your Understanding

WAVE AND ITS CHARACTERISTICS

1. Water waves are of the nature :
(1) Transverse
(2) Longitudinal
(3) Sometimes longitudinal and sometimes transverse and longitudinal both
(4) Neither transverse nor longitudinal
WM0001

2. Sound wave are not polarized because :
(1) Their speed is less
(2) A medium is needed for their propagation
(3) These are longitudinal
(4) Their speed depends on temperature
WM0002

3. A thunder tap is heared 5.5 second after the lightening flash. The distance of the flash is (velocity of sound in air is 330 m/sec.) :-
(1) 3560 m (2) 300 m
(3) 1780 m (4) 1815 m
WM0003

4. Transverse waves can propagate
(1) only in solids
(2) both in solids and gases
(3) neither in solids nor in gases
(4) only in gases
WM0004

5. Transverse elastic waves can be propagate in
(1) Both solid & gas
(2) In solid but not gas
(3) Neither solid nor gas
(4) None
WM0005

6. A wave of frequency 500 Hz travels between X and Y and travel a distance of 600 m in 2 sec. between X and Y. How many wavelength are there in distance XY :
(1) 1000 (2) 300 (3) 180 (4) 2000
WM0006

7. If at a place the speed of a sound wave of frequency 300 Hz is V, the speed of another wave of frequency 150 Hz at the same place will be:
(1) V (2) V/2 (3) 2V (4) 4V
WM0007

8. The equation of a progressive wave for a wire is: $Y = 4\sin\left[\frac{\pi}{2}\left(8t - \frac{x}{8}\right)\right]$. If x and y are measured in cm then velocity of wave is :
(1) 64 cm/s along – x direction
(2) 32 cm/s along – x direction
(3) 32 cm/s along + x direction
(4) 64 cm/s along + x direction
WM0008

9. The equation of progressive wave is $Y = 4\sin\left\{\pi\left(\frac{t}{5} - \frac{x}{9}\right) + \frac{\pi}{6}\right\}$ where x and y are in cm. Which of the following statement is true ?
(1) λ = 18 cm (2) amplitude=0.04 cm
(3) velocity v =50 cm/s (4) frequency f = 20 Hz
WM0009

10. A plane progressive wave is respresented by the equation $y = 0.25\cos(2\pi t - 2\pi x)$.
The equation of a wave is with double the amplitude and half frequency but travelling in the opposite direction will be.
(1) $y = 0.5\cos(\pi t - \pi x)$
(2) $y = 0.5\cos(2\pi t + 2\pi x)$
(3) $y = 0.25\cos(\pi t + 2\pi x)$
(4) $y = 0.5\cos(\pi t + \pi x)$
WM0010

11. A plane wave is described by the equation $y = 3\cos\left(\frac{x}{4} - 10t - \frac{\pi}{2}\right)$. The maximum velocity of the particles of the medium due to this wave is
(1) 30 (2) $\frac{3\pi}{2}$ (3) 3/4 (4) 40
WM0011

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

(1) amplitude 6 units
(2) amplitude 4 units
(3) wave speed 2 units
(4) wave speed 1/2 units

WM0012

13. Due to propagation of longitudinal wave in a medium, the following quantities also propagate in the same direction :

(1) Energy, Momentum and Mass
(2) Energy
(3) Energy and Mass
(4) Energy and Linear Momentum

WM0014

14. The waves in which the particles of the medium vibrate in a direction perpendicular to the direction of wave motion is known as :

(1) transverse waves (2) propagated waves
(3) longitudinal waves (4) stationary waves

WM0015

15. Two wave are represented by equation

$y_1 = a \sin \omega t$ $y_2 = a \cos \omega t$

the first wave –

(1) leads the second by π
(2) lags the second by π
(3) leads the second by $\frac{\pi}{2}$
(4) lags the second by $\frac{\pi}{2}$

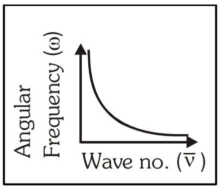
WM0016

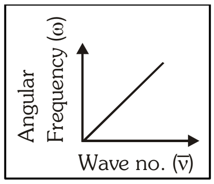
16. The distance between two consecutive crests in a wave train produced in string is 5 m. If two complete waves pass through any point per second, the velocity of wave is

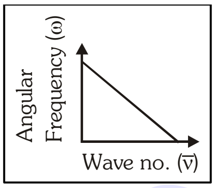
(1) 2.5 m/s (2) 5 m/s
(3) 10 m/s (4) 15 m/s

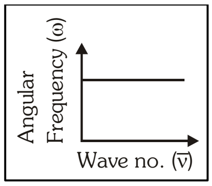
WM0017

17. The graph between wave number ($\bar{\nu}$) and angular frequency (ω) is :

(1)


(2)


(3)


(4)


WM0018

18. The waves produced by a motorboat sailing on water are

(1) Transverse
(2) Longitudinal
(3) Longitudinal and Transverse
(4) Stationary

WM0019

PROGRESSIVE WAVE ON STRING

19. In a string the speed of wave is 10 m/s and its frequancy is 100 Hz . The value of the phase difference at a distance 2.5 cm will be :

(1) $\pi/2$ (2) $\pi/8$ (3) $3\pi/2$ (4) 2π

WM0020

20. 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 and at a point 0.5 m distance from lower end will be :

(1) 5 m/s, 2.24 m/s
(2) 10 m/s, 3.23 m/s
(3) 7.5 m/s, 1.2 m/s
(4) 2.25 m/s, 5 m/s

WM0021

21. The equation of a wave on a string of linear density 0.04 kg m^{-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 :

(1) 6.25 N (2) 4.0 N (3) 12.5 N (4) 0.5 N

WM0022

22. The mathematical forms for three sinusoidal travelling waves are given by

Wave 1 : $y(x,t) = (2cm)\sin(3x-6t)$

Wave 2 : $y(x,t) = (3cm)\sin(4x-12t)$

Wave 3 : $y(x,t) = (4cm)\sin(5x-11t)$

where x is in meters and t is in seconds. Of these waves :

(1) wave 1 has the greatest wave speed and the greatest maximum transverse string speed.

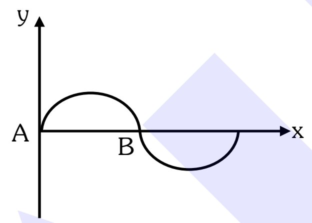
(2) wave 2 has the greatest wave speed and wave 1 has the greatest maximum transverse string speed.

(3) wave 3 has the greatest wave speed and the greatest maximum transverse string speed.

(4) wave 2 has the greatest wave speed and wave 3 has the greatest maximum transverse string speed.

WM0023

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



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

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

(c) A is moving upwards

(d) B is moving upwards

(1) a & c (2) a & d

(3) b & c (4) b & d

WM0024

24. Linear density of a string is 1.3×10^{-4} kg/m and wave equation is $y = 0.021\sin(x + 30t)$. Find the tension in the string where x in meter, t in sec.

(1) 1.17×10^{-2} N (2) 1.17×10^{-1} N

(3) 1.17×10^{-3} N (4) None

WM0025

SOUND WAVES AND ITS CHARACTERISTICS

25. The speed of sound in air at constant temperature

(1) is proportional to the atmospheric pressure.

(2) is proportional to the square of atmospheric pressure.

(3) is proportional to the square root of atmospheric pressure

(4) does not depend on atmospheric pressure.

WM0026

26. At the room temperature the velocity of sound in O_2 gas is V. Then in mixture of H_2 and O_2 gas the speed of sound at same temprature:

(1) will be less than V.

(2) will be more than V

(3) will be equal to V

(4) nothing can be said

WM0027

27. The velocity of sound in a gas depends

(1) only on its wave length

(2) on the density and the elasticity of gas

(3) on intensity of the sound

(4) on the amplitude and the frequency.

WM0028

28. If at some point the amplitude of the sound becomes double and the frequency becomes one fourth then at that point the intensity of sound will be :-

(1) Become double

(2) Be half

(3) Become one fourth

(4) Remain unchanged

WM0029

29. A sound is produced in water and moves towards surface of water and some sound moves in air velocity of sound in water is 1450 m/s and that in air is 330 m/s. When sound moves from water to air then the effect on frequency f and wave length λ will be:

(1) f and λ will remain same

(2) f will remain same but λ will increase

(3) f will remain same but λ will decrease

(4) f will increase and λ will decrease

WM0030

30. When sound wave travels from air to water, which are of the following remain constant :

(1) wavelength (2) velocity

(3) frequency (4) intensity

WM0031

31. Newton's formula for the velocity of sound in gases is :

(1) $v = \sqrt{\frac{2p}{\rho}}$ (2) $v = \sqrt{\frac{p}{\rho}}$

(3) $v = \sqrt{\frac{\rho}{p}}$ (4) $v = \frac{3}{2}\sqrt{\frac{p}{\rho}}$

WM0032

32. Intensity level of a sound of intensity I is 30 dB. The ratio I/I_0 is

(I_0 is the threshold of hearing)

(1) 1000 (2) 3000

(3) 300 (4) 30

WM0033

33. If v_m is the velocity of sound in moist air and v_d is the velocity of sound in dry air then :

(1) $v_m < v_d$ (2) $v_m > v_d$

(3) $v_d >> v_m$ (4) $v_m = v_d$

WM0034

34. A sine wave has an amplitude A and wavelength λ. Let V be wave velocity and v be the maximum velocity of a particle in medium then.

(1) V = v if $A = \frac{\lambda}{2\pi}$

(2) V can not be equal to v

(3) V = v if $\lambda = \frac{3A}{2\pi}$

(4) V= v if A = 2 $\pi\lambda$

WM0035

35. 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 :

(1) 2a (2) 8a

(3) 4a (4) a

WM0036

36. The velocities of sound at the same pressure in two monoatomic gases of densities ρ_1 and ρ_2 are v_1 and v_2 respectively. If $\frac{\rho_1}{\rho_2} = 4$, then the value of $\frac{v_1}{v_2}$ is :

(1) $\frac{1}{4}$ (2) $\frac{1}{2}$ (3) 2 (4) 4

WM0037

37. The time period of SHM of a particle is 12 s. The phase difference between the position at t = 3s and t = 4s will be :

(1) $\pi/4$ (2) $3\pi/5$

(3) $\pi/6$ (4) $\pi/2$

WM0038

38. Velocity of sound in medium is V. If the density of the medium is doubled, what will be the new velocity of sound ?

(1) $\sqrt{2}V$ (2) V (3) $V/\sqrt{2}$ (4) 2V

WM0039

REFLECTION OF WAVES AND ECHO

39. A man standing on a cliff claps his hand and hears its echo after one second. If the sound in reflected from another mountain then the distance between the man & reflection points is V_{sound} = 340 m/sec.

(1) 680 m (2) 340 m

(3) 170 m (4) 85 m

WM0040

PRINCIPLE OF SUPERPOSITION OF WAVES : INTERFERENCE, BEATS

40. At a particle two simple harmonic motion are acting along the same direction. These are $y_1 = a_1 \sin \omega t$ and $y_2 = a_2 \sin(\omega t + \phi)$. The resultant motion is also a simple harmonic motion whose amplitude will be:

(1) $a_1^2 + a_2^2 + 2a_1a_2 \text{Cos}\phi$

(2) $\sqrt{a_1^2 + a_2^2 + 2a_1a_2 \text{Cos}\phi}$

(3) $\sqrt{a_1^2 + a_2^2 - 2a_1a_2 \text{Cos}\phi}$

(4) $a_1^2 + a_2^2 - 2a_1a_2 \text{Cos}\phi$

WM0041

41. The energy in the superposition of waves :
(1) Is lost
(2) Increase
(3) remain same, only redistribution occurs
(4) None of the above

WM0042

42. Waves from two sources superimpose on each other at a particular point. Amplitude and frequency of both the waves are equal. The ratio of intensities when both waves reach in the same phase and they reach with the phase difference of 90^0 will be
(1) 1:1 (2) √2:1 (3) 2:1 (4) 4:1

WM0043

43. Two waves whose intensity are same (I) move towards a point P in same phase, then the resultant intensity at point P will be:
(1) 4 I (2) 2 I (3) √2 I (4) None

WM0044

44. Ratio of amplitudes of two waves is 3:4. The ratio of maximum and minimum intensity obtained from them will be :
(1) 7:1 (2) 49:1 (3) 1:25 (4) 5:1

WM0045

45. Two coherent sources of intensities I_1 and I_2 produce an interference pattern, the maximum intensity in the interference patteren will be –
(1) $I_1 + I_2$ (2) $I_1^2 + I_2^2$
(3) $(I_1+I_2)^2$ (4) $\left(\sqrt{I_1}+\sqrt{I_2}\right)^2$

WM0046

46. Intensities ratio of two waves are 9:1 then the ratio of their maximum and minimum intensities will be:-
(1) 10 : 8 (2) 7 : 2 (3) 4 : 1 (4) 2 : 1

WM0047

47. When two tuning forks are sounded together x beats/sec are heard and frequency of A is n. Now when one prong of B is loaded with a little wax, the number of beats per second decreases. The frequency of fork B is :
(1) n + x (2) n – x (3) n – x^2 (4) n – 2x

WM0048

48. A source x of unknown frequency produces 8 beats with a source of 250 Hz and 12 beats with a source of 270 Hz. The frequency of source x is:
(1) 258 Hz (2) 242 Hz
(3) 262 Hz (4) 282 Hz

WM0049

49. Two waves of wave length 2 m and 2.02 m respectively moving with the same velocity and superimpose to produce 2 beats per sec. The velocity of the waves is:
(1) 400.0 m/s (2) 402 m/s
(3) 404 m/s (4) 406 m/s

WM0050

50. A tuning fork A produces 4 beats/sec. with another tuning fork B of frequency 288 Hz. If fork A is loaded with little wax no. of beats per sec decreases. The frequency of the fork A, before loading wax is :
(1) 290 Hz (2) 288 Hz
(3) 292 Hz (4) 284 Hz

WM0051

51.

Column I		Column II	
A	Longitudinal waves	P	Particles of the medium vibrate perpendicular to the wave propagation.
B	Transverse waves	Q	Two progressive waves of slightly different frequencies superimpose in the same direction
C	Beats	R	Two progressive waves of same frequency superimpose in the opposite directions
D	Stationary waves	S	Particles of the medium vibrate along the wave propagation.

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

WM0052

52. What is the path difference for destructive interference?
(1) $n\lambda$ (2) $n(\lambda + 1)$
(3) $\frac{(n+1)\lambda}{2}$ (4) $\frac{(2n+1)\lambda}{2}$

WM0053

53. When beats are produced by two progressive waves of the same amplitude and of nearly the same frequency, the ratio of maximum intensity to the intensity of one of the waves will be n. Where n is

(1) 3 (2) 1 (3) 4 (4) 2

WM0054

54. What is the beat frequency produced when following two waves are sounded together ?

$x_1 = 10 \sin(404\pi t - 5\pi x)$,

$x_2 = 10 \sin(400\pi t - 5\pi x)$.

(1) 4 (2) 1 (3) 3 (4) 2

WM0099

55. Two waves having equation

$x_1 = a \sin(\omega t + \phi_1)$ $x_2 = a \sin(\omega t + \phi_2)$

If in the resultant wave the frequency and amplitide remains equals to amplitude of superimposing waves. Then phase diff. between them –

(1) $\frac{\pi}{6}$ (2) $\frac{2\pi}{3}$ (3) $\frac{3\pi}{4}$ (4) $\frac{\pi}{4}$

WM0056

56. Two sources have frequency 256 Hz and 258 Hz, then time difference between two consecutive maxima is –

(1) 1 s (2) 0·5 s
(3) 2 ms (4) None

WM0057

57. Two vibrating tuning forks produce progressive 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:

(1) 3 (2) 360 (3) 180 (4) 60

WM0058

58. Two plane progressive waves shows destructive interference at point P. Which of the following statement is true at point P :-

(1) Crest of one wave is superimposed on crest of another wave
(2) Trough of one wave is superimposed on crest of another wave
(3) Intensity of resultant wave is equal to the intensity difference of two waves
(4) Resultant amplitude is equal to the amplitude sum of two waves

WM0059

STATIONARY WAVES OR STANDING WAVES IN STRINGS

59. A uniform string of length L and mass M is fixed at both ends under tension T, then it can vibrate with frequency given by the formula.

(1) $f = \frac{1}{2}\sqrt{\frac{T}{ML}}$ (2) $f = \frac{1}{2L}\sqrt{\frac{T}{M}}$
(3) $f = \frac{1}{2}\sqrt{\frac{T}{M}}$ (4) $f = \frac{1}{2}\sqrt{\frac{M}{LT}}$

WM0060

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

(1) (7/2) Hz (2) (7/4) Hz
(3) (14) Hz (4) (2/7) Hz

WM0061

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

(1) $y = a \sin(\omega t + kx)$
(2) $y = -a \cos(\omega t - kx)$
(3) $y = -a \cos(\omega t + kx)$
(4) $y = -a \sin(\omega t - kx)$

WM0065

62. A stretched string is vibrating according to the equation $y = 5\sin\left(\frac{\pi x}{2}\right)\cos 4\pi t$, where y and a are in cm and t is in sec. The distance between two consecutive nodes on the strings is :-

(1) 2 cm (2) 4 cm (3) 8 cm (4) 16 cm

WM0066

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

(1) 5 m/s (2) 10 m/s
(3) 20 m/s (4) 40 m/s

WM0074

64. Stationary wave is represented by $Y = A \sin (100\ t) \cos (0.01\ x)$ where y and A are in mm, t in sec and x in m. The velocity of the wave:

(1) 1 m/s (2) 10^2 m/s

(3) 10^4 m/s (4) zero

WM0075

65. If the tension in a sonometer wire is increased by a factor of four then fundamental frequency of vibration changes by a factor of :

(1) 4 (2) (1/4) (3) 2 (4) (1/2)

WM0076

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

(1) 1 kg. (2) $\sqrt{6}$ kg

(3) 6 kg (4) 36 kg

WM0077

67. Stationary waves are produced in 10m long streched string. If the string vibrates in 5 segments and wave velocity is 20m/sec, then the frequency is-

(1) 10 Hz (2) 5 Hz

(3) 4 Hz (4) 2Hz

WM0078

68. A standing wave having 3 nodes and 2 antinodes is formed between 1.21 Å distance then the wavelength is

(1) 1.21 Å (2) 2.42 Å

(3) 0.605 Å (4) 4.84 Å

WM0079

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

(1) 100 Hz (2) 50 Hz

(3) 150 Hz (4) 200 Hz

WM0080

70. If vibrations of a string are to be increased to a factor of two, then tension in the string must be made :

(1) half (2) thrice

(3) four times (4) eight times

WM0081

71. Stationary waves are so called because in them –

(1) The particles of the medium are not disturbed at all

(2) The particles of the medium do not execute S.H. M.

(3) There occur no flow of energy along the wave

(4) The interference effect can't be observed

WM0083

72. In a sonometer wire, the tension is maintained by suspending a mass M from free end of wire. The fundamental frequency of the wire is N Hz. If the suspended mass is completely immerged in water the fundamental frequency will

(1) increases (2) constant

(3) decrease (4) can't say

WM0085

73. A second harmonic has to generated in a string of length ℓ stretched between two rigid supports. The points where the string has to be plucked and touched are –

(1) Pluck at $\frac{\ell}{2}$ touch at $\frac{3\ell}{4}$

(2) Pluck at $\frac{\ell}{2}$ touch at $\frac{\ell}{4}$

(3) Pluck at $\frac{\ell}{4}$ touch at $\frac{3\ell}{4}$

(4) Pluck at $\frac{\ell}{4}$ touch at $\frac{\ell}{2}$

WM0086

74. If the tension and diameter of a sonometer wire of fundamental frequency (n) is doubled and density is halved then its fundamental frequency will become :-

(1) $\frac{n}{4}$ (2) $\sqrt{2}n$

(3) n (4) $\frac{n}{\sqrt{2}}$

WM0089

75. The tension in a piano wire is 10N. What should be the tension in the wire to produce a note of double the frequency ?

(1) 10N (2) 20N
(3) 40N (4) 80N

WM0090

76. Fundamental frequency of sonometer wire is n. If the length, tension and diameter of wire are tripled, the new fundamental frequency is :-

(1) $n/\sqrt{3}$ (2) $n/3$
(3) $n\sqrt{3}$ (4) $n/3\sqrt{3}$

WM0093

77. 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 :

(1) 62.5 cm (2) 50 cm
(3) 40 cm (4) 37.5

WM0094

78. Four wires of identical lengths, diameters and of the same material are stretched on a sonometer wire. The ratio of their tension is 1 : 4 : 9 : 16. The ratio of their fundamental frequencies is

(1) 1 : 2 : 3 : 4 (2) 16 : 9 : 4 : 1
(3) 1 : 4 : 9 : 16 (4) 4 : 3 : 2 : 1

WM0095

79. Given equation is related to

$$y = \cos\left(\frac{2\pi}{\lambda}x\right)\cos(2\pi\nu t)$$

(1) Transverse progressive
(2) Longitudinal progressive
(3) Longitudinal stationary wave
(4) Transverse stationary wave

WM0096

80. A stretched string is 1 m long. Its mass per unit length is 0.5 g/m. It is stretched with a force of 20 N. It plucked at a distance of 25 cm from one end. The frequency of note emitted by it will be:

(1) 400 Hz (2) 300 Hz
(3) 200 Hz (4) 100 Hz

WM0098

STATIONARY WAVE IN ORGAN PIPES

81. With the increase of temperature, the frequency of the organ pipe-

(1) increases (2) decreases
(3) remains unchanged (4) can not say

WM0062

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

(1) decreases
(2) increases
(3) depends on the purity of water
(4) remains the same

WM0063

83. The end correction of resonance tube is 1 cm. If lowest resonant length is 15 cm then next resonant length will be :-

(1) 36 cm (2) 45 cm (3) 46 cm (4) 47 cm

WM0067

84. If the fundamental frequency for a COP is n, then the next three overtones will have ratio :-

(1) 2 : 3 : 4 (2) 3 : 4 : 5
(3) 3 : 7 : 11 (4) 3 : 5 : 7

WM0068

85. A tube closed at one end and containing air produces, when excited, the fundamental note of frequency 512 Hz. If the tube is open at both ends, the fundamental frequency that can be excited is (in Hz)

(1) 1024 (2) 512 (3) 256 (4) 128

WM0069

86. An air column in pipe,which is closed at one end will be in resonance with a vibrating tuning fork of frequency 264 Hz if the length of the column in cm is : [v = 330 m/s]

(1) 31.25 (2) 62.50 (3) 110 (4) 125

WM0070

87. Velocity of sound in air is 320 m/s. A pipe closed at one end has a length of 1 m neglecting end corrections, the air column in the pipe can resonant for sound of frequency.

(a) 80 Hz (b) 240 Hz
(c) 500 Hz (d) 400 Hz

(1) a (2) a,b (3) a,b,d (4) a,d

WM0071

88. The velocity of sound in air is 330 m/s. The fundamental frequency of an organ pipe open at both ends and of length 0.3 metre will be:

(1) 200 Hz (2) 550 Hz (3) 300 Hz (4) 275 Hz

WM0072

89. An air column having one end closed contains minimum resonance length 50 cm. If it is vibrated by same tuning fork then its next resonance length will be –

(1) 250 cm (2) 200 cm
(3) 150 cm (4) 100 cm

WM0082

90. If the air column in a pipe which is closed at one end, is in resonance with a vibrating tuning fork of frequency 260 Hz, then the length of the air column is : (v_{sound} = 330 m/s)

(1) 35.7 cm (2) 31.7 cm
(3) 12.5 cm (4) 62.5 cm

WM0088

91. A sound wave of frquency 330Hz is incident normally at reflected wall then minimum distance from wall at which partical vibrate very much :-
(V_{sound} = 330 m/s)

(1) 0.25 m (2) 0.125 m
(3) 1 m (4) 0.5 m

WM0091

92. An open organ pipe of length 33 cm, vibrates with frequency 1000 Hz. If velocity of sound is 330 m/s, then its frequency is:-

(1) Fundamental frequency
(2) First overtone of pipe
(3) Second overtone
(4) Fourth overtone

WM0092

93. If V is the speed of sound in air then the shortest length of the closed pipe which resonants to a frequency n :

(1) $\frac{V}{2n}$ (2) $\frac{V}{4n}$
(3) $\frac{4n}{V}$ (4) $\frac{2n}{V}$

WM0097

94. The lengths of two closed organ pipes are 0.750 m and 0.770 m. If they are sounded together, 3 beats per second are produced. The velocity of sound will be :-

(1) 350.5 m/sec (2) 335.5 m/sec
(3) 346.5 m/sec (4) None of these

WM0055

95. 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)

(1) 50 cm (2) 100 cm
(3) 75 cm (4) 25 cm

WM0100

96. 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:-

(1) 5.5 mm, 60 kHz (2) 3.30 m, 60kHz
(3) 5.5 mm, 30 kHz (4) 5.5 mm, 80 kHz

WM0101

97. An organ pipe 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

(1) 14 (2) 13 (3) 6 (4) 9

WM0102

98. Length of the close organ pipe is 1 m. At which frequency resonance will not occur (v = 320 m/sec.)

(1) 80 Hz (2) 240 Hz
(3) 300 Hz (4) 400 Hz

WM0103

99. An open resonating tube has fundamental frequency of n. When half of its length is dipped into water, then its fundamental frequency will be:

(1) n (2) n/2 (3) 2n (4) 3/2 n.

WM0105

100. A pipe is closed from one end and open from another end then which statement is true ?

(1) Node is formed slightly above the open end.
(2) Node is formed slightly below the open end.
(3) Antinode is formed slightly above the open end.
(4) Antinode formed slightly below the open end.

WM0106

DOPPLER EFFECT IN SOUND WAVES AND LIGHT WAVES

101. The apparent change in the pitch of sound due to relative motion between observer and the source is called:
(1) Doppler's effect
(2) Resonance of waves
(3) interference
(4) none of the above

WM0107

102. A siren blown in workshop emits waves of frequency 1000 Hz. A car driver approaches the workshop with velocity 90 km/hour then frequency of sound heard by driver will be in Hz. (V_{sound} = 330 m/s)
(1) 926 (2) 1076
(3) 1176 (4) 1000

WM0108

103. A star is continuously moving away from us than the wavelength coming from star on the earth :
(1) Will shift towards violet colour
(2) Will shift towards red colour.
(3) remain unchanged
(4) Will shift sometimes towards violet and some other time it will shift towards red colour.

WM0109

104. Doppler's effect in the form of frequency doesn't depend upon :
(1) Frequency produced by waves
(2) Velocity of source
(3) Velocity of observer.
(4) Separation between source & observer.

WM0111

105. The term "Red shift" referring to doppler's effect for light repersent which of following property :
(1) decrease in frequency
(2) increase in frequency
(3) decrease in intensity
(4) Increase in intensity

WM0113

106. A source and an observer moves away from each other, with a velocity of 15 m/sec with respect to ground. If observer finds the frequency of sound coming from source as 1950 Hz. Then actual frequency of source will be
(velocity of sound = 340 m/sec.) :
(1) 1785 Hz (2) 1968 Hz
(3) 1950 Hz (4) 2130 Hz

WM0114

107. A source of sound of frequency n and a listener approach each other with a velocity equal to $\frac{1}{20}$ of velocity of sound. The apparent frequency heard by the listener is :
(1) $\left(\frac{21}{19}\right)n$ (2) $\left(\frac{20}{21}\right)n$ (3) $\left(\frac{21}{20}\right)n$ (4) $\left(\frac{19}{20}\right)n$

WM0115

108. A source of sound of frequency 1000 Hz is moving with a uniform velocity 20 m/s. The ratio of apparent frequency heard by the observer before and after the source crosses him would be :
[v= 340 m/s]
(1) 9 :8 (2) 8:9 (3) 1:1 (4) 9:10

WM0116

109. Two sound sources (of same frequency) are placed at distance of 100 meter. An observer, when moving between both sources, hears 4 beats per second. The distance between sound source is now changed to 400 meter then the beats/second heard by observer will be:
(1) 2 (2) 4 (3) 8 (4) 16

WM0117

110. Doppler effect for sound depends upon the relative motion of source and listener and it also depends upon that which one of these is in motion. Whereas in doppler effect for light it only depends upon the relative motion of the source of light and observer. The reason for it is :
(1) Einstein's mass energy relation
(2) Einstein's theory of relativity
(3) Photo electric effect
(4) none of above

WM0118

111. 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 :

(1) 550 Hz (2) 458.3 Hz
(3) 530 Hz (4) 545.5 Hz

WM0119

112. A bus is moving with a velocity of 5 m/s towards a huge wall. The driver sounds a horn of frequency 165Hz. If the speed of sound in air is 335 m/s, No. of beats heared by a passenger on bus will be–

(1) 6 (2) 5 (3) 3 (4) 4

WM0120

113. The wavelength of a distant star is 5700 A° and the spectral light has a shift of 1.9 A° towards red end then the velocity of star relative to the earth will be:

(1) 5×10^5 m/sec (2) 2×10^5 m/sec
(3) 1.8×10^5 m/sec (4) 1×10^5 m/sec.

WM0122

114. Two trains A and B are moving in the same direction with velocities 30 m/s and 10 m/s respectively. B is behind from A and A blows a horn of frequency 450 Hz. Then the apparent frequency heard by observer on train B is (speed of sound is 330 m/s):

(1) 425 Hz (2) 300 Hz
(3) 450 Hz (4) 350 Hz

WM0123

115. If a star emitting light of wavelength 5000 Å is moving towards earth with a velocity of 1.5×10^6 m/s then the shift in the wavelength due to Doppler's effect will be :

(1) 2.5 Å (2) 250 Å
(3) 25 Å (4) Zero

WM0124

116. Two stationary sources each emitting waves of wave length λ. An observer moves from one source to other with velocity u. Then number of beats heared by him :-

(1) $\frac{2u}{\lambda}$ (2) $\frac{u}{\lambda}$ (3) $\sqrt{u\lambda}$ (4) $\frac{u}{2\lambda}$

WM0125

117. 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 : (Take velocity of sound in air 330 m/s) :

(1) $n_1 = 10\,n$ (2) $n_1 = -n$
(3) $n_1 = 0$ (4) $n_1 = 2n$

WM0126

118. Doppler effect for light differs from that for sound in regards that :

(1) the relative frequency shift is smaller for light than for sound.
(2) the velocity addition valid for sound is not true for light waves.
(3) velocity of light is very large as compared to sound.
(4) light waves are electromagnetic waves but sound waves are mechanical.

WM0127

119. If a source is moving away from a stationary observer with half of velocity of sound. The frequency observed will be :-

(1) one-third (2) doubled
(3) halved (4) two-third

WM0128

120. A siren emitting sound of frequency 800 Hz is going away, from a static listener, with a speed of 30 m/s. Frequency of sound to be heared by the listener is : (Velocity of sound = 330 m/s) :-

(1) 286.5 Hz (2) 481.2 Hz
(3) 733.3 Hz (4) 644.8 Hz

WM0129

121. As temperature increase, difference between apparent doppler frequency and actual frequency
(1) Decreases
(2) Remains unchanged
(3) Increases
(4) Depending on frequency, increase or decrease.

WM0130

122. An observer moves towards a stationary source of sound with a speed 1/5th of the speed of sound. The wavelength and frequency of the source are λ and f respectively. The apparent frequency and wavelength recorded by the observer are respectively :–

(1) 1.2f, 1.2λ (2) 1.2f, λ

(3) f, 1.2λ (4) 0.8f, 0.8λ

WM0131

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

(1) 4.5 Hz.

(2) 4.5×10^{16} Hz.

(3) 4.485×10^{14} Hz.

(4) 4.5×10^{8} Hz.

WM0132

EXERCISE-I (Conceptual Questions) ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	**3**	**3**	**4**	**2**	**2**	**1**	**1**	**4**	**1**	**4**	**1**	**3**	**4**	**1**	**4**
Que.	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Ans.	**3**	**2**	**3**	**1**	**1**	**1**	**4**	**2**	**2**	**4**	**2**	**2**	**3**	**3**	**3**
Que.	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
Ans.	**2**	**1**	**2**	**1**	**2**	**2**	**3**	**3**	**3**	**2**	**3**	**3**	**1**	**2**	**4**
Que.	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Ans.	**3**	**1**	**1**	**3**	**3**	**2**	**4**	**3**	**4**	**2**	**2**	**3**	**2**	**1**	**2**
Que.	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
Ans.	**3**	**1**	**3**	**4**	**3**	**3**	**2**	**1**	**1**	**3**	**3**	**3**	**4**	**3**	**3**
Que.	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
Ans.	**4**	**3**	**1**	**4**	**3**	**1**	**2**	**4**	**4**	**1**	**1**	**3**	**2**	**3**	**2**
Que.	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105
Ans.	**1**	**2**	**2**	**3**	**1**	**1**	**3**	**3**	**1**	**3**	**1**	**2**	**2**	**4**	**1**
Que.	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
Ans.	**4**	**1**	**1**	**2**	**2**	**1**	**2**	**4**	**1**	**3**	**1**	**3**	**2**	**4**	**3**
Que.	121	122	123												
Ans.	**1**	**2**	**3**												

EXERCISE-II (Previous Year Questions) AIPMT/NEET

AIPMT 2006

1. Which one of the following statements is true:-
(1) Both light and sound waves in air are transverse
(2) The sound waves in air are longitudinal while the light waves are transverse
(3) Both light and sound waves in air are longitudinal
(4) Both light and sound waves can travel in vacuum

WM0133

AIPMT 2009

2. The driver of a car travelling with speed 30 m/sec towards a hill, sounds a horn of frequency 600 Hz. If the velocity of sound in air is 330 m/s, the frequency of reflected sound as heard by driver is
(1) 500 Hz (2) 550 Hz
(3) 555.5 Hz (4) 720 Hz

WM0137

3. A wave in a string has an amplitude of 2cm. The wave travels in the + ve direction of x axis with a speed of 128 m/sec and it is noted that 5 complete waves fit in 4 m length of the string. The equation describing the wave is :-
(1) y = (0.02) m sin (7.85x – 1005t)
(2) y = (0.02) m sin (7.85x + 1005t)
(3) y = (0.02) m sin (15.7x – 2010t)
(4) y = (0.02)m sin (15.7x + 2010t)

WM0138

AIPMT (Pre) 2010

4. A transverse wave is represented by y = A sin (ωt – kx). For what value of the wavelength is the wave velocity equal to the maximum particle velocity ?
(1) A (2) $\frac{\pi A}{2}$ (3) πA (4) 2πA

WM0139

5. A tuning fork of frequency 512 Hz makes 4 beats per second with the vibrating string of a piano. The beat frequency decreases to 2 beats per seconds when the tension in the piano string is slightly increased. The frequency of the piano string before increasing the tension was :
(1) 508 Hz (2) 510 Hz
(3) 514 Hz (4) 516 Hz

WM0140

AIPMT (Pre) 2011

6. Two waves are represented by the equations y_1 = asin (ωt + kx + 0.57) m and y_2 = a cos (ωt + kx) m where x is in meter and t in sec. The phase difference between them is :-
(1) 1.0 radian
(2) 1.25 radian
(3) 1.57 radian
(4) 0.57 radian

WM0141

7. Sound waves travel at 350 m/s through a warm air and at 3500 m/s through brass. The wavelength of a 700 Hz acoustic wave as it enters brass from warm air :
(1) decreases by a factor 10
(2) increases by a factor 20
(3) increases by a factor 10
(4) decreases by a factor 20

WM0142

AIPMT (Mains) 2011

8. Two 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 :-
(1) 0.01 (2) 0.02
(3) 0.03 (4) 0.04

WM0143

AIPMT (Pre) 2012

9. Two sources of sound placed close 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 will hear :-
(1) 8 beats per second with intensity ratio 81 : 1 between waxing and waning
(2) 4 beats per second with intensity ratio 81 : 1 between waxing and waning
(3) 4 beats per second with intensity ratio 25 : 16 between waxing and waning
(4) 8 beats per second with intensity ratio 25 : 16 between waxing and waning

WM0145

AIPMT (Mains) 2012

10. The equation of a simple harmonic wave is given by :

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

where x and y are in metres and t is in seconds. The ratio of maximum particle velocity to the wave velocity is :-

(1) 3π (2) $\frac{2}{3}\pi$

(3) 2π (4) $\frac{3}{2}\pi$

WM0146

NEET-UG 2013

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

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

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

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

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

WM0148

12. 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 Hz. The unknown frequency is

(1) 260 Hz (2) 254 Hz

(3) 246 Hz (4) 240 Hz

WM0149

13. If we study the vibration of a pipe open at both ends, then the following statement is not true :

(1) Pressure change will be maximum at both ends

(2) Open end will be antinode

(3) Odd harmonics of the fundamental frequency will be generated

(4) All harmonics of the fundamental frequency will be generated

WM0150

AIPMT 2014

14. If n_1, n_2 and n_3 are the fundamental frequencies of three segments into which a string is divided, then the original fundamental frequency n of the string is given by :-

(1) $\frac{1}{n} = \frac{1}{n_1} + \frac{1}{n_2} + \frac{1}{n_3}$

(2) $\frac{1}{\sqrt{n}} = \frac{1}{\sqrt{n_1}} + \frac{1}{\sqrt{n_2}} + \frac{1}{\sqrt{n_3}}$

(3) $\sqrt{n} = \sqrt{n_1} + \sqrt{n_2} + \sqrt{n_3}$

(4) $n = n_1 + n_2 + n_3$

WM0152

15. 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})

(1) 4 (2) 5

(3) 7 (4) 6

WM0153

AIPMT 2015

16. The fundamental frequency of a closed organ pipe of length 20 cm 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 :-

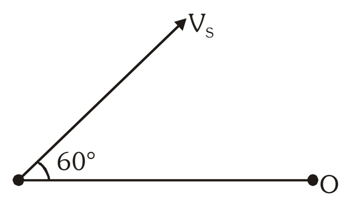
(1) 100 cm (2) 120 cm

(3) 140 cm (4) 80 cm

WM0155

RE-AIPMT-2015

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



(1) 97 Hz (2) 100 Hz

(3) 103 Hz (4) 106 Hz

WM0156

18. A string is stretched between two fixed points separated by 75.0 cm. It is observed to have resonant frequencies of 420 Hz and 315 Hz. There are no other resonant frequencies between these two. The lowest resonant frequencies for this string is :-

(1) 105 Hz (2) 155 Hz
(3) 205 Hz (4) 10.5 Hz

WM0157

NEET-I 2016

19. A siren emitting a sound of frequency 800 Hz moves away from an observer towards a cliff at a speed of $15 ms^{-1}$. Then, the frequency of sound that the observer hears in the echo reflected from the cliff is :
(Take velocity of sound in air = $330 ms^{-1}$)

(1) 765 Hz (2) 800 Hz
(3) 838 Hz (4) 885 Hz

WM0160

20. A uniform rope of length 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 λ_2/λ_1 is :

(1) $\sqrt{\frac{m_1}{m_2}}$ (2) $\sqrt{\frac{m_1+m_2}{m_2}}$
(3) $\sqrt{\frac{m_2}{m_1}}$ (4) $\sqrt{\frac{m_1+m_2}{m_1}}$

WM0161

21. An air column, closed at one end and open at the other, resonates with a tuning fork when the smallest length of the column is 50 cm. The next larger length of the column resonating with the same tuning fork is :

(1) 66.7 cm (2) 100 cm
(3) 150 cm (4) 200 cm

WM0162

NEET-II 2016

22. 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

(1) $\frac{L}{2}$ (2) 4 L
(3) L (4) 2 L

WM0163

23. 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 :-

(1) 3 (2) 2 (3) 1 (4) 4

WM0164

NEET(UG) 2017

24. 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?

(1) 20 Hz (2) 30 Hz
(3) 40 Hz (4) 10 Hz

WM0170

25. Two cars moving in opposite directions approach each other with speed of 22 m/s and 16.5 m/s respectively. The driver of the first car blows a horn having a frequency 400 Hz. The frequency heard by the driver of the second car is [velocity of sound 340 m/s] :-

(1) 361 Hz (2) 411 Hz
(3) 448 Hz (4) 350 Hz

WM0171

NEET(UG) 2018

26. A tuning fork is used to produce resonance in a glass tube. The length of the air column in this tube can be adjusted by a variable piston. At room temperature of 27°C two successive resonances are produced at 20 cm and 73 cm column length. If the frequency of the tuning fork is 320 Hz, the velocity of sound in air at 27°C is:-

(1) 330 m/s (2) 339 m/s
(3) 350 m/s (4) 300 m/s

WM0173

27. 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 :-

(1) 13.2 cm (2) 8 cm
(3) 12.5 cm (4) 16 cm

WM0174

NEET(UG) 2019 (Odisha)

28. A tuning fork with frequency 800 Hz produces resonance in a resonance column tube with upper end open and lower end closed by water surface. Successive resonance are observed at length 9.75 cm, 31.25 cm and 52.75 cm. The speed of sound in air is :-

(1) 500 m/s (2) 156 m/s
(3) 344 m/s (4) 172 m/s

WM0251

NEET(UG) 2020

29. In a guitar, two strings A and B made of same material are slightly out of tune and produce beats of frequency 6 Hz. When tension in B is slightly decreased, the beat frequency increases to 7 Hz. If the frequency of A is 530 Hz, the original frequency of B will be:

(1) 537 Hz (2) 523 Hz
(3) 524 Hz (4) 536 Hz

WM0252

NEET(UG) 2020 (Covid-19)

30. The length of the string of a musical instrument is 90 cm and has a fundamental frequency of 120 Hz. Where should it be pressed to produce fundamental frequency of 180 Hz ?

(1) 75 cm (2) 60 cm (3) 45 cm (4) 80 cm

WM0253

NEET (UG) 2021(Paper-2)

31. Two vibrating strings A and B of same material but lengths 2L and 3L have radii 3r and 2r respectively. They are stretched under same tension. String A vibrates in fundamental mode and string B in second overtone. The ratio of their frequencies n_A/n_B will be

(1) 1 : 2 (2) 1 : 3 (3) 1 : 4 (4) 2 : 3

WM0254

32. If a pipe gives notes of frequencies 255, 425 and 595, what is fundamental frequency of the pipe and its type?

(1) 85, open pipe (2) 17, closed pipe
(3) 51, open pipe (4) 85, closed pipe

WM0255

NEET (UG) 2022

33. If the initial tension on a stretched string is doubled, then the ratio of the initial and final speeds of a transverse wave along the string is:

(1) $\sqrt{2}:1$ (2) $1:\sqrt{2}$
(3) 1:2 (4) 1:1

WM0256

NEET (UG) 2022 (Overseas)

34. A string of length l is fixed at both ends and is vibrating in second harmonic. The amplitude at antinode is 2 mm. The amplitude of a particle at a distance $\frac{l}{8}$ from the fixed end is:

(1) 4 mm (2) $\sqrt{2}$ mm
(3) $2\sqrt{3}$ mm (4) $2\sqrt{2}$ mm

WM0257

Re-NEET (UG) 2022

35. An organ pipe filled with a gas at 27°C resonates at 400 Hz in its fundamental mode. If it is filled with the same gas at 90°C, the resonance frequency at the same mode will be :-

(1) 420 Hz (2) 440 Hz
(3) 484 Hz (4) 512 Hz

WM0258

EXERCISE-II (Previous Year Questions) ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	2	4	1	4	1	1	3	2	2	4	2	2	1	1	4
Que.	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Ans.	2	3	1	3	2	3	4	2	1	3	2	1	3	3	2
Que.	31	32	33	34	35										
Ans.	2	4	2	2	2										

EXERCISE-III (Analytical Questions)

Master Your Understanding

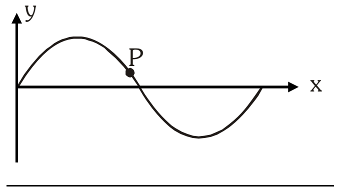
1. Transverse wave of same frequency are generated in two steel wires A and B. The diameter of A is twice of B and the tension in A is half that in B. The ratio of velocities of waves in A and B is –

(1) $1:\sqrt{2}$ (2) 1 : 2

(3) $3:2\sqrt{2}$ (4) $1:2\sqrt{2}$

WM0178

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



(1) $\frac{\sqrt{3}\pi}{50}\hat{i}$ m/s (2) $-\frac{\sqrt{3}\pi}{50}\hat{j}$ m/s

(3) $\frac{\sqrt{3}\pi}{50}\hat{j}$ m/s (4) $-\frac{\sqrt{3}\pi}{50}\hat{i}$ m/s

WM0179

3. The power of sound from the speaker of a radio is 20 milliwatt. By turning the knob of the volume control the power of the sound is increased to 400 milliwatt. The power increase in decibles as compared to the original power is :

(1) 13 db (2) 10 db

(3) 20 db (4) 800 db

WM0180

4. Frequency of tuning fork A is 256 Hz. It produces four beats/sec with tuning fork B. When wax is applied at tuning fork B then 6 beats/sec are heard. Frequency of B is :

(1) 252

(2) 260 Hz

(3) (1) & (2) both

(4) 264

WM0181

5. A set of 56 tuning forks are so arranged in series that each fork gives 4 beats per second with the previous one. The freq. of the last fork is 3 times that of first. The freq. of first fork is :

(1) 110 (2) 60 (3) 56 (4) 65

WM0183

6. Two wires are fixed in a sonometer. Their tensions are in the ratio 8:1. The lengths are in the ratio 36:35. The diameters are in the ratio 4:1. Densities of the materials are in the ratio 1:2. If the higher frequency in the setting is 360 Hz, the beat frequency when the two wires sounded together is:

(1) 8 (2) 5 (3) 10 (4) 6

WM0184

7. Sound source of frequnecy 170 Hz is placed near a wall. A man walking from the source towards the wall finds, that there is periodic rise and fall of sound intensity. If the speed of sound in air is 340 m/s, then the distance separating the two adjacent portions of minimum intensity is:

(1) (1/2) m (2) (3/2) m

(3) 1 m (4) 2 m

WM0185

8. An open pipe is suddenly closed with the result that the second overtone of the closed pipe is found to be higher in frequency by 100 Hz, than the first overtone of the original pipe. The fundamental frequency of open pipe will be :

(1) 100 Hz (2) 300 Hz

(3)150 Hz (4) 200 Hz

WM0186

9. An under water swimmer sends a sound signal to the surface. It produces 5 beats/sec when compared with fundamental tone of a pipe of 20 cm length closed at one end. What is wavelength of sound in water.

(take V_{water} = 1500 m/sec, V_{air} = 360m/sec)

(1) 3.3 m or 3.37 m

(2) 4.4 m or 4.47 m

(3) 2.5 m or 2.7 m

(4) 1m or 1.7 m

WM0188

10. A cylindrical tube (L = 120 cm.) is resonant with a tuning fork of frequency 330 Hz. If it is filling by water then to get resonance minimum length of water column is (V_{air} = 330 m/s)

(1) 45 cm. (2) 60 cm.
(3) 25 cm. (4) 20 cm.

WM0189

11. A man standing between two cliffs hears the first echo of a sound after 2 sec and the second echo 3 sec after the intial sound. If the speed of sound be 330 m/s, the distance between the two cliffs should be:

(1) 1650 m (2) 990 m
(3) 825 m (4) 660 m

WM0190

12. A vibrator makes 150 cm of a string to vibrate in 6 loops in the longitudinal arrangement when it is stretched by 150 N. The entire length of the string is then weighed and is found to weigh 400 mg. Then

(1) frequency of the vibrator is 3 kHz
(2) frequency of the vibrator is 1.5 kHz
(3) distance between two nodes is 25 cm
(4) distance between two nodes is 33 cm

WM0192

13. The equation of a plane progressive wave is $y = 0.02 \sin 8\pi \left[t - \frac{x}{20}\right]$. When it is reflected at a rarer medium (medium with higher velocity) at x = 0, its amplitude becomes 75% of its previous value. The equation of the reflected wave is

(1) $y = 0.02 \sin 8\pi \left[t - \frac{x}{20}\right]$

(2) $y = 0.02 \sin 8\pi \left[t + \frac{x}{20}\right]$

(3) $y = +0.015 \sin 8\pi \left[t + \frac{x}{20}\right]$

(4) $y = -0.015 \sin 8\pi \left[t + \frac{x}{20}\right]$

WM0193

14. A sonometer wire resonates with a given tuning fork forming standing waves with five antinodes between the two bridges when a mass of 9kg is suspended from the wire. When this mass is replaced by mass M, the wire resonates with the same tuning fork forming three antinodes for the same positions of the bridges. Then find the value of square root of M.

(1) 5 (2) 10
(3) 25 (4) None

WM0194

15. An observer moves towards a stationary source of sound with a velocity one tenth of the velocity of sound. The apparent increase in frequency is -

(1) zero (2) 5% (3) 10% (4) 0.1%

WM0196

16. A railway engine moving with a speed of 60 m/sec passes in front of a stationary listner. The real frequency of whistle is 400 Hz. Calculate the apparent frequency heared by listner (a) when the engine is approaching the listener. (b) when the engine moving away from the (V = 340 m/sec) listener

(1) 484 Hz, 340 Hz (2) 220 Hz, 180 Hz
(3) 320 Hz,155 Hz (4) 400 Hz, 330 Hz

WM0198

17. A sound source is moving with speed 5 m/s towards a wall. If the velocity of sound is 330 m/s the stationary observer would hear beats is equal to(frequency of source = 240 Hz) -

(1) 0 (2) 0 or 8
(3) 8 (4) 0 or 4

WM0199

18. A person observes two trains one of there is coming with speed of 4m/sec and another is going with same speed. If two trains blowing a whistle with frequency 240 Hz. The beat frequency heard by stationary person will be (speed of sound in air = 320 m/sec.)

(1) zero (2) 3 (3) 6 (4) 12

WM0200

19. Two source of sound s_1 and s_2 emitting sound of frequency 324 Hz and 320 Hz are situated at certain distance apart. An observer moves along the line joining the two sources. What should be the velocity of the observer if no beats are heard: (Velocity of sound is 344 m/s)

(1) 20 m/s (2) 10 m/s
(3) 5 m/s (4) 2.1 m/s

WM0202

20. Length of a sonometer wire is either 95 cm or 100 cm, in both the cases a tuning fork produces 4 beats. Then the frequency of tuning fork is-

(1) 152 (2) 156 (3) 160 (4) 164

WM0204

21. A tuning fork gives 4 beats with 50 cm length of a sonometer wire. If the length of the wire is shortened by 1 cm then no. of beats still the same. The frequency of the fork is –

(1) 396 (2) 400 (3) 404 (4) 384

WM0206

22. A body is walking away from a wall towards an observer at a speed of 1 m/s and blows a whistle whose frequency is 680 Hz. The number of beats heard by the observer per second is :-

(velocity of sound in air = 340 m/s)

(1) 4 (2) 8 (3) 2 (4) zero

WM0207

23. 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 :-

(1) 500 (2) 300 (3) 330 (4) 165

WM0208

24. A whistle revolves in a circle with angular speed ω = 20 rad/sec using a string of length 50 cm. If the frequency of sound from the whistle is 385 Hz, then what is the minimum frequency heard by an observer which is far away from the centre: (V_{sound} = 340 m/s)

(1) 385 Hz (2) 374 Hz
(3) 394 Hz (4) 333 Hz

WM0209

25. An earthquake generates both transverse (S) and longitudinal (P) sound waves in the earth. The speed of S waves is about 4.5 km/s and that of P waves is about 8.0 km/s. A seismograph records P and S waves from an earthquake. The first P wave arrives 4.0 min before the first S wave. The epicenter of the earthquake is located at a distance of about

(1) 25 km (2) 250 km
(3) 2500 km (4) 5000 km

WM0210

26. 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 :

(1) $\frac{v}{3}$ (2) $\frac{v}{4}$
(3) $\frac{v}{2}$ (4) $\frac{v}{\sqrt{2}}$

WM0211

EXERCISE-III (Analytical Questions) ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	**4**	**3**	**1**	**3**	**1**	**3**	**3**	**4**	**1**	**1**	**3**	**2,3**	**3**	**1**	**3**
Que.	16	17	18	19	20	21	22	23	24	25	26				
Ans.	**1**	**2**	**3**	**4**	**2**	**1**	**1**	**1**	**2**	**3**	**1**				