EXERCISE-I (Conceptual Questions) **Build Up Your Understanding**

WAVE AND ITS CHARACTERISTICS

1. Water wave is are of the nature :
(1) Transverse
(2) Longitudinal
(3) Sometimes longitudinal and some times transverse and longitudinal both
(4) Neither transverse nor longitudinal

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

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

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

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

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

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

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

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

10. A plane progressive wave is represented 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) $y = 0.5 \cos(\pi t + \pi x)$

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

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

13. The equation of ·a progressive wave are $Y = \sin\left[200\pi\left(t - \frac{x}{330}\right)\right]$, where x is in meter and f is in second. The frequency and velocity of wave are

(1) 100 Hz, 5 m/s (2) 300 Hz, 100 m/s (3) 100Hz, 330 m/s (4) 30 m/s, 5 Hz

14. 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

15. 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

16. Two wave are represented by equation

$y_1 = a \sin \omega t$ $y_2 = a \cos \omega t$ the first wave -

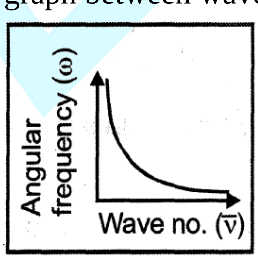
(1) leads the second by π (2) lags the second by π

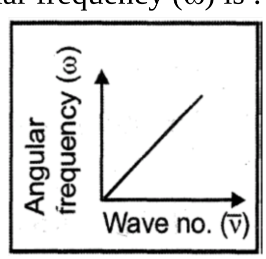
(3) leads the second by $\frac{\pi}{2}$ (4) lags the second by $\frac{\pi}{2}$

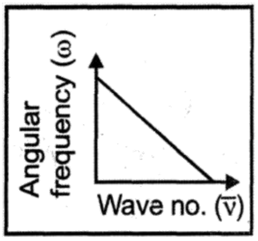
17. The distance between two consecutive crests in a wave train produced in string is 5 m. If two complete waves pass through any point per second, the velocity of wave is

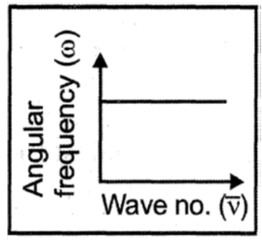
(1) 2.5 m/s (2) 5 m/s (3) 10 m/s (4) 15 m/s

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

(1) 

(2) 

(3) 

(4) 

19. The waves produced by a motorboat sailing on water are
(1) Transverse (2) Longitudinal
(3) Longitudinal and Transverse (4) Stationary

PROGRESSIVE WAVE ON STRING

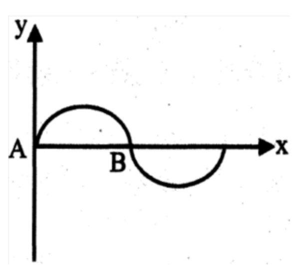
20. In a string the speed of wave is 10 m/s and its frequency is 100 Hz . The value of the phase difference at a distance 2.5 cm will be :
(1) $\pi / 2$ (2) $\pi / 8$ (3) $3\pi / 2$ (4) 2π

21. 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

22. 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

23. 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.

24. 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

25. Linear density of a string is 1.3×10^{-4} kg/m and wave equation is y = 0.021 sin(x + 30 t). 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

SOUND WAVES AND ITS CHARACTERISTICS

26. 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.

27. 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 temperature :

(1) will be less than V (2) will be more than V

(3) will be equal to V (4) nothing can be said

28. 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

29. lf 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

30. 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

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

(1) wavelength (2) velocity (3) frequency (4) intensity

32. 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) $v = \frac{3}{2}\sqrt{\frac{p}{\rho}}$

33. 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

34. If υ_m is the velocity of sound in moist air and υ_d is the velocity of sound in dry air then :

(1) $\upsilon_m < \upsilon_d$ (2) $\upsilon_m > \upsilon_d$ (3) $\upsilon_d >> \upsilon_m$ (4) $\upsilon_m = \upsilon_d$

35. 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) $V = \nu$ if $A = \frac{\lambda}{2\pi}$
(2) V can not be equal to ν
(3) $V = \nu$ if $\lambda = \frac{3A}{2\pi}$
(4) $V = \nu$ if $A = 2\pi\lambda$

36. 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

37. The velocities of sound at the same pressure in two monoatomic gases of densities p_1 and P_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

38. 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) $\pi/5$ (3) $\pi/6$ (4) $\pi/2$

39. Velocity of sound in medium is V. If the density of the medium is doubled, what will be the new velocity of sound ?
(1) $\sqrt{2}V$ V (2) V (3) $V/\sqrt{2}$ (4) 2V

REFLECTION OF WAVES AND ECHO

40. 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

PRINCIPLE OF SUPERPOSITION OF WAVES

41. 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) $a_1^2 + a_2^2 + 2a_1a_2 \cos\phi$
(2) $\sqrt{a_1^2 + a_2^2 + 2a_1a_2 \cos\phi}$
(3) $\sqrt{a_1^2 + a_2^2 - 2a_1a_2 \cos\phi}$
(4) $a_1^2 + a_2^2 - 2a_1a_2 \cos\phi$

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

43. 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° will be

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

44. 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) 41 (2) 2 I (3) $\sqrt{2}$ I (4) None

45. 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

46. Two coherent sources of intensities I_1 and I_2 produce an interference pattern, the maximum intensity in the interference pattern will be -

(1) $I_1 + I_2$ (2) $I_1^2 + I_2^2$ (3) $(I_1 + I_2)^2$ (4) $\left(\sqrt{I_2}+\sqrt{I_2}\right)^2$

4 7. 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

48. 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

49. 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

50. Two waves of wave length 2m 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

51. A tuning fork produces 4 beats/sec. with another tuning fork B of frequency 288 Hz. If fork is loaded with little wax no. of beats per sec decreases. The frequency of the fork A, before loading is

(1) 290 Hz (2) 292 Hz (3) 292 Hz (4) 284 Hz

52.

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	S	Particles of the medium vibrate along

	waves		the wave propagation.

(1) AQ, 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

53. What is the path difference for destructive interference ?

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

54. 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

55. 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

56. 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) $\frac{\pi}{4}$

57. 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

58. 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

59. 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

STATIONARY WAVES OR STANDING WAVES IN STRINGS & ORGAN PIPES

60. 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) $f = \frac{1}{2}\sqrt{\frac{M}{LT}}$

61. 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

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

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

63. 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

64. A string is rigided by two ends and its equation is given by $y = \cos 2\pi t \ \sin 2\pi tx$

Then minimum length of string is

(1) 1 m (2) 1 / 2 m (3) 5 m (4) 2π m

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

66. 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

67. 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

68. 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

69. 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

70. 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

71. Velocity of sound in air is 320 m/s. A pipe closed at one end has a length of 1 m neglecting end correction, 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, c (4) a, d

72. 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 meter will be:
(1) 200 Hz (2) 550 Hz (3) 300 Hz (4) 275 Hz

73. A hollow metallic tube of length L and closed at one end produce resonance with a tuning fork of frequency n. The entire tube is then heated carefully so that at equilibrium temperature its length changes by λ. If the change in velocity V of sound is v, the resonance will now be produced by tuning fork of frequency.
(1) (V + v) / [4(L + λ)] (2) (V + v) / [4(L – λ)]
(3) (V – v) / [4(L + λ)] (4) (V – v) / [4(L – λ)]

74. 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

75. 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

76. 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)

77. 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

78. Stationary waves are produced in 10 m long stretched string. If the string vibrates in 5 segments and wave velocity is 20 m/sec, then the frequency is-
(1) 10 Hz (2) 5 Hz (3) 4 Hz (4)2 Hz

79. 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

80. 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

81. If vibration 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

82. 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

83. Stationary waves are so called because in them-
(1) The particles of the medium are not disturbed at all
(2) The particles of 1he 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

84. The maximum length of a closed pipe that would produce a just audible sound is (V_{sound}=336 m/s)
(1) 4.2 cm (2) 4.2 m (3) 4.2 mm (4) 1.0 cm

85. 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 water the fundamental frequency will
(1) increases (2) constant (3) decrease (4) can't say

86. A second harmonic has to generated fn a string of length λ stretched between two rigid supports. The points where the string has to be plucked and touched are –
(1) Pluck at $\frac{l}{2}$ touch at $\frac{3l}{4}$ (2) Pluck at $\frac{l}{2}$ touch at $\frac{l}{4}$
(3) Pluck at $\frac{l}{4}$ touch at $\frac{3l}{4}$ (4) Pluck at $\frac{l}{4}$ touch at $\frac{l}{2}$

87. A wave is represented by the equation $y = a \sin(kx - \omega t)$ is superimposed with another wave to form a stationary wave such that the point x = 0 is a node. Then the equation of other wave is -
(1) $y = a \cos (kx - \omega t)$ (2) $y = a\cos (kx + \omega t)$
(3) $y = - a\sin (kx + \omega t)$ (4) $y = a \sin (kx + \omega t)$

88. 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 :
(1) 35.7 cm (2) 31.7 cm (3) 12.5 cm (4) 62.5 cm

89. 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) $\frac{n}{2}$

90. The tension in a piano wire is 10 N. What should be the tension in the wire to produce a note of double the frequency ?
(1) 10 N (2) 20 N (3) 40 N (4) 80 N

91. A sound wave of frequency 330 Hz is incident normally at reflected wall then minimum distance from wall at which particle vibrate very much :-
(V_{sound} = 300 m/s)
(1) 0.25 m (2) 0.125 m (3) 1 m (4) 0.5 m

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

93. 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) $n / 3\sqrt{3}$

94. 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

95. Four wires of identical lengths, diameters and of the same material are stretched on 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

96. Given equation is related to $y = \cos\left(\frac{2\pi}{\lambda}x\right)\cos(2\pi vt)$

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

97. 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) $\frac{2n}{V}$

98. 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

99. 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

100. 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 .

101. 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, 60 kHz (3) 5.5 mm, 30 kHz (4) 5.5 mm, 80 kHz

102. 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

103. 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

104. A 10 cm long organ pipe is open at one end and closed at other end. What is the maximum wavelength of wave produced by it :-
(1) 40 cm (2) 20 cm (3) 10 cm (4) 5 cm

105. 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

106. 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.

DOPPLER EFFECT IN SOUND WAVES AND LIGHT WAVES

107. 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

108. 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

109. 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.

110. A source of frequency 200 Hz is moving towards an observer with a velocity equal to the sound velocity V. If observer also moves away from the source with same velocity then apparent frequency heard by observer will be :
(1) 50 Hz (2) 160 Hz (3) 150 Hz (4) 200 Hz

111. 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.

112. The wavelength of the light received from a galaxy is 0.4% greater than the wave length on the earth then the velocity of galaxy relative to the earth will be:
(1) 1.2×10^7 m/sec (2) 1.2×10^6 m/sec (3) 1.2×10^5 m/sec (4) 1.2×10^4 m/sec

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

114. 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

115. 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) $\left(\frac{19}{20}\right)n$

116. 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 observe 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

117. 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

118. 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

119. 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

120. A bus is moving with a velocity of 5 m/s towards a huge wall. The driver sound a horn of frequency 165 Hz. 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

121. A sound source is going away from an observer with the sound speed. The apparent frequency which the observer listen
(1) will be half (2) will remain is same
(3) will be double (4) will not be observed

122. The wavelength of a distant star is 5700 Å and the spectral light has a shift of 1.9 Å 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.

123. 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

124. 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

125. Two stationary sources each emitting waves of wave length λ. An observer moves from one source other with velocity u. Then number of beats heared by him :
(1) $\frac{2u}{\lambda}$ (2) $\frac{u}{\lambda}$ (3) $\sqrt{u\lambda}$ (4) $\frac{u}{2\lambda}$

126. 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) $n_1 = 2n$

127. 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 sound waves are mechanical.

128. 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

129. 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

130. 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

131. An observer moves towards a stationary source of sound with a speed l/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

132. 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.

ANSWER KEY

EXERCISE-I (Conceptual Questions)

1.	(3)	**2.**	(3)	**3.**	(4)	**4.**	(2)	**5.**	(2)	**6.**	(1)	**7.**	(1)
8.	(4)	**9.**	(1)	**10.**	(4)	**11.**	(1)	**12.**	(3)	**13.**	(3)	**14.**	(4)
15.	(1)	**16.**	(4)	**17.**	(3)	**18.**	(2)	**19.**	(3)	**20.**	(1)	**21.**	(1)

22.	(1)	**23.**	(4)	**24.**	(2)	**25.**	(2)	**26.**	(4)	**27.**	(2)	**28.**	(2)
29.	(3)	**30.**	(3)	**31.**	(3)	**32.**	(2)	**33.**	(1)	**34.**	(2)	**35.**	(1)
36.	(2)	**37.**	(2)	**38.**	(3)	**39.**	(3)	**40.**	(3)	**41.**	(2)	**42.**	(3)
43.	(3)	**44.**	(1)	**45.**	(2)	**46.**	(4)	**47.**	(3)	**48.**	(1)	**49.**	(1)
50.	(3)	**51.**	(3)	**52.**	(2)	**53.**	(4)	**54.**	(3)	**55.**	(3)	**56.**	(2)
57.	(2)	**58.**	(3)	**59.**	(2)	**60.**	(1)	**61.**	(2)	**62.**	(1)	**63.**	(2)
64.	(2)	**65.**	(3)	**66.**	(1)	**67.**	(4)	**68.**	(4)	**69.**	(1)	**70.**	(1)
71.	(3)	**72.**	(2)	**73.**	(1)	**74.**	(3)	**75.**	(4)	**76.**	(3)	**77.**	(3)
78.	(2)	**79.**	(1)	**80.**	(1)	**81.**	(3)	**82.**	(3)	**83.**	(3)	**84.**	(2)
85.	(3)	**86.**	(4)	**87.**	(4)	**88.**	(2)	**89.**	(3)	**90.**	(3)	**91.**	(1)
92.	(2)	**93.**	(4)	**94.**	(3)	**95.**	(1)	**96.**	(4)	**97.**	(2)	**98.**	(3)
99.	(4)	**100.**	(1)	**101.**	(1)	**102.**	(3)	**103.**	(3)	**104.**	(1)	**105.**	(1)
106.	(3)	**107.**	(1)	**108.**	(2)	**109.**	(2)	**110.**	(4)	**111.**	(4)	**112.**	(2)
113.	(1)	**114.**	(4)	**115.**	(1)	**116.**	(1)	**117.**	(2)	**118.**	(2)	**119.**	(1)
120.	(2)	**121.**	(1)	**122.**	(4)	**123.**	(1)	**124.**	(3)	**125.**	(1)	**126.**	(3)
127.	(2)	**128.**	(4)	**129.**	(3)	**130.**	(1)	**131.**	(2)	**132.**	(3)		