WAVES & SOUNDS

1. Velocity of sound waves in air is 330 m/s. For a particular sound wave in air, a path difference of 40 cm is equivalent to phase difference of 1.6 π. The frequency of this wave :

(a) 165 Hz (b) 150 Hz

(c) 660 Hz (d) 330 Hz

2. The distance between two consecutive crests in a wave train produced in a string in 5 cm. If 2 complete waves pass through any point per second, the velocity of the wave is :

(a) 10 cm/sec (b) 2.5 cm/sec

(c) 5 cm/sec (d) 15 cm/sec

3. Two simple harmonic motions of same amplitude, same frequency and a phase difference of $\frac{\pi}{4}$ are superimposed at right angles to each other on a particle. The particle will describe a :

(a) circle (b) ellipse

(c) figure of eight (d) straight line

4. The composition of two simple harmonic motions of equal periods at right angles to each other and with a phase difference of π results in the displacement of the particle along :

(a) straight line (b) circle

(c) ellipse (d) figure of eight

5. Consider ten identical sources of sound all giving the same frequency but having phase angles which are random. If the average intensity of each source is I_0, the average of resultant intensity I due to all these ten sources will be :

(a) $I = 100\ I_0$ (b) $I = 10\ I_0$

(c) $I = I_0$ (d) $I = \sqrt{10}\ I_0$

6. Ten tuning forks are arranged in increasing order of frequency in such a way that any two nearest tuning forks produce 4 beats per se(c) the highest frequency is twice that of the lowest. Possible highest and lowest frequencies are :

(a) 80 and 40 (b) 100 and 50

(c) 44 and 32 (d) 72 and 36

7. The transverse wave represented by the equation $y = 4 \sin\left(\frac{\pi}{6}\right) \sin(3x - 15t)$ has :

(a) amplitude = 4

(b) wavelength = $4\frac{\pi}{3}$

(c) speed of propagation = 5

(d) period = $\frac{\pi}{15}$

8. The equation of stationary wave along a stretched string is given by $y = 4 \sin \frac{2\pi x}{3} \cos 40\ \pi t$, where x and y are in cms and t in secs. The separation between two adjacent nodes in :

(a) 3 cm (b) 1.5 cm

c) 6 cm (d) 4 cm

9. 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 metres and t is in seconds. The expression represents :

(a) a wave traveling in the positive X direction with a velocity of 1.5 m/s

(b) a wave traveling in the –ve X direction with a velocity of 1.5 m/sec

(c) a wave traveling in the –ve X direction with a wavelength of 0.2 metre

(d) a wave traveling in the +ve x direction with a wavelength of 0.2 metre

10. A star is moving away from the earth with a velocity of 10 m/s. The shift in the spectral line of wavelength 5700 Å as observed on the earth is :

(a) 0.53 Å (b) 1.06 Å

(c) 1.90 Å (d) 3.80 Å

11. A source of sound emitting a tone of frequency 200 Hz moves towards an observer with a velocity V equal to the velocity of soun(d) If the observer also moves away from the source with the same velocity V, the apparent frequency heard by the observer is :

(a) 50 Hz (b) 100 Hz

(c) 150 Hz (d) 200 Hz

12. A radio wave of frequency 840 Mhz is sent towards an aeroplane. The frequency of the radio echo has a frequency 2.8 KHz more than the original frequency. Then the velocity of the aeroplane is :

(a) 3 km/sec (b) 2 km/sec

(c) 4 km/sec (d) 0.5 km/sec

13. Two wires of the same material and radii r and 2 r respectively are welded together end to en(d) The combination is used as a sonometer wire and kept under tension T. the welded point is mid–way between the two bridges. When stationary waves are set up in the composite wire, the joint is a node. Then the ratio of the number of loops formed in the thinner to thicker wire is :

(a) 2 : 3 (b) 1 : 2

c) 2 : 1 (d) 5 : 4

14. String wires of same material of length l and 2l vibrate with frequencies 100 and 150 respectively. The ratio of their tension is :

(a) 2 : 3 (b) 3 : 2

(c) 1 : 9 (d) 1 : 3

15. In a closed organ pipe, the fundamental frequency is n. What will be the ratio of the frequencies of the next three overtones :

(a) 2 : 3 : 4 (b) 3 : 4 : 5

(c) 3 : 7 : 11 (d) 3 : 5 : 7

16. A wave traveling along a stretched string is represented by $y = 3 \cos \pi (100\ t - x)$. Its wavelength is :

(a) 3 cm (b) 100 cm

(c) 2 cm (d) 5 cm

17. Four simple harmonic vibrations $y_1 = 8 \cos \omega t$, $y_2 = 4 \cos \left(\omega t + \frac{\pi}{2}\right)$, $y_3 = 2 \cos (\omega t + \pi)$, $y_4 = \cos \left(\omega t + \frac{3\pi}{2}\right)$ are superimposed on one another. The resulting amplitude and phase are respectively :

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

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

(c) $\sqrt{75}$ and $\tan^{-1}\left(\frac{1}{2}\right)$

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

18. Two tuning forks A and B vibrating simultaneously produce 5 beats. Frequency of B is 512. It is seen that if one arm of A is filed, then the no. of beats increases. Frequency of A will be :

(a) 502 (b) 507

(c) 517 (d) 522

19. The frequency of radar is 780 MHz. The frequency of the reflected wave from an aeroplane is increased by 2.6 KHz. The velocity of the aeroplane is :

(a) 0.25 km/sec (b) 0.5 km/sec

(c) 1.0 km/sec (d) 2.0 km/sec

20. A sonometer wire is in unison with a tuning fork. Keeping the same tension, the length of the wire between the bridges is double(d) The tuning fork can still be in resonance with the wire, provided the wire now vibrates in :

(a) 4 segments (b) 6 segments

(c) 3 segments (d) 2 segments

21. The sonometer wire is vibrating in the second overtone. We may say that there are :

(a) two nodes and two antinodes

(b) one node and two antinodes

(c) four nodes and three antinodes

(d) three nodes and three antinodes

22. A tuning fork vibrating with a sonometer having 20 cm wire produces 5 beats/se(c) The beat frequency doesn't change if the length of the wire is changed to 21 cm. The frequency of the tuning form (in hertz) must be :

(a) 200 (b) 210

(c) 205 (d) 215

23. 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 ad four antinodes

24. The speed of sound in air is 350 m/s. The fundamental frequency of an open pipe 50 cm long will be :

(a) 175 hk (b) 350 hz

(c) 700 hz (d) 50 hz

25. If the pressure amplitude in a sound wave is tripled then by what factor the intensity of sound wave is increased :

(a) 3 (b) 6

(c) 9 (d) $\sqrt{3}$

26. The distance between two points differing in phase by 60^{o} on a wave having a wave velocity 360 m/s and frequency 500 hz is :

(a) 0.72 metre (b) 0.12 metre

(c) 0.18 metre (d) 0.36 metre

27. The velocity of sound in any gas depends upon :

(a) wavelength of sound only

(b) density and elasticity of gas

(c) intensity of sound waves only

(d) amplitude and frequency of sound

28. If the amplitude of sound is doubled and the frequency 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 factor of 2

(c) decreasing by a factor of 4

(d) unchanged

29. A stone is dropped into a lake from a tower 500 metre high. The sound of splash will be heard by the man approximately after :

(a) 11.5 sec (b) 21 sec

(c) 10 sec (d) 14 sec

30. A 5.5 metre length of string has a mass of 0.035 kg. If the tension in the string in 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}

31. What type of vibration are produced in a sitar wire:

(a) progressive transverse

(b) progressive longitudinal

(c) stationary transverse

(d) stationary longitudinal

32. A closed organ pipe and an open organ pipe have their first overtone identical in frequency. Their lengths are in the ratio :

(a) 1 : 2 (b) 2 : 3

(c) 3 : 4 (d) 4 : 5

33. 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 :

(a) 100 hz (b) 300 hz

(c) 150 m/s (d) 200 hz

34. The speed of sound in air is :

(a) proportional to the pressure of air

(b) proportional to the square of the pressure of air

(c) proportional to the square root of the pressure of air

(d) independent of the pressure of air

35. If a place the speed of a sound wave of frequency 330 Hz is V, the speed of another wave of frequency 150 Hz at the same place will be :

(a) V (b) $\frac{V}{2}$

(c) 2V (d) 4V

36. A wave is represented by $x = 0.4 \cos\left(8t - \frac{y}{2}\right)$ where x and y are in metres and t in seconds. The frequency of the wave is :

(a) $\frac{4}{\pi}\text{sec}^{-1}$ (b) $\frac{8}{\pi}\text{sec}^{-1}$

(c) $\frac{\pi}{\pi}\text{sec}^{-1}$ (d) $\frac{\pi}{\pi}\text{sec}^{-1}$

37. The intensity of a harmonic wave :

(a) depends upon its frequency and not on its amplitude

(b) depends upon its amplitude and not on its frequency

(c) depends upon both, its frequency and amplitude

(d) depends neither on frequency nor on its amplitude

38. The number of beats produced per second by the vibrations $x_1 = a \sin 320 \pi t$ and $x_2 = a \sin 326 \pi t$ is :

(a) 6 (b) 4

(c) 3 (d) 2

39. When two tuning forks A and B are sounded together, X beats/sec are hear(d) Frequency of A is n. Now when one prong of fork B is loaded with a little wax, the no. of beats/sec decreases. The frequency of fork B is :

(a) n + X (b) n – X

(c) $n - X^2$ (d) n – 2 X

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

(a) $\frac{7}{2}$ Hz (b) $\frac{7}{4}$ Hz

(c) 14 Hz (d) $\frac{2}{7}$ Hz

41. The velocity of sound is generally greater in solids than in gases because :

(a) the density of solids is high but the elasticity is low

(b) the density of solids is high but the elasticity of solids is very high

(c) both the density and elasticity of solids are low

(d) the density of solids is low but the elasticity is high

42. The path difference between two waves

$y_1 = a_1 \sin\left(\omega t - \frac{2\pi x}{\lambda}\right)$

and $y_2 = a_2 \cos\left(\omega t - \frac{2\pi x}{\lambda} + \phi\right)$ is :

(a) $\frac{\lambda}{2\pi}(\phi)$ (b) $\frac{\lambda}{2\pi}\left(\phi + \frac{\pi}{2}\right)$

(c) $\frac{2\pi}{\lambda}\left(\phi - \frac{\pi}{2}\right)$ (d) $\frac{2\pi}{\lambda}(\phi)$

43. Which of the following equations represents a wave :

(a) $y = A \sin \omega t$

(b) $y = A \cos kx$

(c) $y = A \sin (at - bx + c)$

(d) $y = A(\omega t - kx)$

44. A source and listener are both moving towards each other with speed $\frac{V}{10}$ where V is the speed of soun(d) 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) 1,12 f (d) 1.27 f

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

(a) 750 Hz (b) 857 Hz

(c) 1143 Hz (d) 1333 Hz

46. A wave of frequency 100 Hz is sent along a string towards a fixed en(d) When this wave travels back, after reflection, a node is formed at a distance of 10 cm from the fixed end of the string. The speeds of incident (and reflected) waves are :

(a) 5 m/s (b) 10 m/s

(c) 20 m/s (d) 40 m/s

47. A string under a tension of 129.6 newton produces 10 beats / sec, when it is vibrated along with a tuning fork. When the tension in the string is increased to 160 newton, it sounds in unison with the same tuning fork. Then frequency of tuning fork is :

(a) 110 hz (b) 90 hz

(c) 110 hz (d) 220 hz

48. $y = 25 \cos(2\pi t - \pi x)$ is the wave equation. Then the amplitude and frequency are respectively :

(a) 100, 25 (b) 200, 25

(c) 25, 100 (d) 25, 1.00

49. The relation between phase difference and path difference is :

(a) $\Delta\phi = \frac{2\pi}{\lambda}(\Delta x)$ (b) $\Delta\phi = 2\pi\lambda(\Delta x)$

(c) $\Delta\phi = \frac{2\pi\lambda}{\Delta x}$ (d) $\Delta\phi = \frac{2\Delta x}{\lambda}$

50. A change in temperature affects which property of sound :

(a) frequency (b) amplitude

(c) wavelength (d) loudness

ANSWERS KEY

1	C	11	D	21	C	31	C	41	B
2	A	12	D	22	C	32	C	42	B
3	B	13	B	23	D	33	B	43	C
4	A	14	C	24	B	34	C	44	B
5	B	15	D	25	C	35	A	45	A
6	D	16	C	26	B	36	A	46	C
7	C	17	A	27	B	37	C	47	A
8	B	18	C	28	C	38	c	48	D
9	B,C	19	B	29	A	39	A	49	A
10	C	20	D	30	A	40	B	50	C