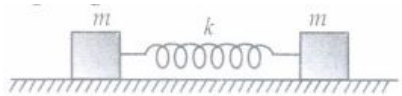
Ravi Maths Tuition Centre

Time : 1 Mins **OSCILLATIONS' ANS WAVES 1** **Marks : 1113**

1. Mark the correct statement.
   a) In case of stationary waves, maximum pressure change occurs at antinodes
   b) In case of stationary waves, maximum pressure change occurs at nodes
   c)
   In case of stationary waves, amplitude of pressure change is same at all the nodes and antinodes
   d) In case of stationary waves, no pressure change takes place
2. Which of the following is not a transverse wave?
   a) X-rays b) γ-rays c) Visible light wave d) Sound wave in a gas
3. If we study the vibration of a pipe open at both ends, then which of the following statements is not true?
   a) Odd harmonics of the fundamental frequency will be generated
   b) All harmonics of the fundamental frequency will be generated
   c) Pressure change will be maximum at both ends d) Antinode will be at open end
4. A policeman blows a whistle with a frequency of 500 Hz. A car approaches him with a velocity of 15 m S^{-1}. The change in frequency as heard by the driver of the car as he passes the policeman is (Given, speed of sound in air is 300 m S^{-1})
   a) 25 Hz b) 50 Hz c) 100 Hz d) 150 Hz
5. A particle executing simple harmonic motion with time period T. The time period with which its kinetic energy oscillates is:
   a) T b) 2T c) 4T d) $\frac{T}{2}$
6. The equation of a wave traveling on a string is $y = 4\sin\left[\frac{\pi}{2}\left(8t - \frac{x}{8}\right)\right]$, where x, y are in cm and t in second. The velocity of the wave.is:
   a) 64cm Is, in - X-direction b) 32cm Is , in - X -direction c) 32cm/s, in + X-direction
   d) 64 cm/s , in + X -direction
7. Two blocks each of mass m is connected to the spring of spring constant k as shown in the figure



   If the blocks are displaced slightly in opposite directions and released, they will execute simple harmonic motion. The time period of oscillation is
   a) $2\pi\sqrt{\frac{m}{k}}$ b) $2\pi\sqrt{\frac{m}{2k}}$ c) $2\pi\sqrt{\frac{m}{4k}}$ d) $2\pi\sqrt{\frac{2m}{k}}$
8. Ten tuning forks are arranged in increasing order of their frequencies in such a way that any two nearest tuning forks produce 4 beats per second. 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 22 d) 72 and 36
9. Which of the following wave functions does not represent a travelling wave?

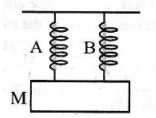
a) $y = \tan (x - vt)^2$ b) $y = \log(x + vt)$ c) $y=\frac{1}{x+vt}$ d) All of these

10. 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 of sound will hear:
    a) 8 beats per second with intensity ratio 81: 1 between waxing and waning.
    b) 4 beats per second with intensity ratio 81: 1 between waxing and waning.
    c) 4 beats per second with intensity ratio 25: 16 between waxing and waning.
    d) 8 beats per second with intensity ratio 25: 16 between waxing and waning.
11. Which of the following relationships between the acceleration a and the displacement x of a particle executing simple harmonic motion?
    a) $a= 2X^2$ b) $a = - 2X^2$ c) $a=2x$ d) $a=-2x$
12. A block of mass m is hanging vertically by spring of spring constant k. If the mass is made to oscillate vertically, its total energy is
    a) maximum at the extreme position b) maximum at the mean position
    c) minimum at the mean position d) same at all positions
13. The equation of a wave on a string of linear mass 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:
    a) 4.0 N b) 12.5 N c) 0.5 N d) 6.25 N
14. The equation of the stationary wave is: $y = 2A\sin\left(\frac{2\pi ct}{\lambda}\right)\cos\left(\frac{2\pi x}{\lambda}\right)$. Which of the following statements is wrong?
    a) The unit of ct is same as that of λ b) The unit of x is same as that of λ
    c) The unit of $2\pi c/\lambda$ is same as that of $2\pi x/\lambda t$ d) The unit of c/λ is same as that of x/λ
15. Velocity of sound is measured in hydrogen and oxygen gases at a given temperature. The ratio of the two velocities will be:
    a) 1:4 b) 4:1 c) 1:1 d) 32:1
16. When pressure increased by 1 atmosphere and temperature increases by 1^0C, the velocity of sound
    a) decreases by 0.61 ms^{-l} b) increases by 61 ms^{-1} c) decreases by 61 m s^{-1}
    d) increases by 0.61 m s^{-1}
17. In the following question, a statement of assertion is followed by a statement of reason. Mark the correct choice as :
    Assertion: The amplitude of oscillation can never be infinite.
    Reason : The energy of oscillator is continuously dissipated
    a) If both assertion and reason are true and reason is the correct explanation of assertion
    b) If both assertion and reason are true but reason is not the correct explanation of assertion
    c) If assertion is true but reason is false d) If both assertion and reason are false
18. A transverse wave propagating along x-axis is represented by $y(x, t) = 8.0\sin\left(0.5\pi x - 4\pi t - \frac{\pi}{4}\right)$ where x is in metres and t in seconds. The speed of the wave is _____ .
    a) 0.5pm/s b) $\frac{\pi}{4}$ m/s c) 8 m/s d) 4pm/s
19. 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) $I = \sqrt{10}I_0$

20. From a wave equation $y = 0.5\sin\frac{2\pi}{3.2}(64t - x)$, the frequency of the wave is _____ .
    a) 5 Hz b) 15 Hz c) 20 Hz d) 25 Hz

21. A source of sound gives 5 beats per second when sounded with another source of frequency 100 per second. The second harmonic of the source, together with a source of frequency 205 per second, gives 5 beats per second. What is the frequency of the source?
    a) 95 sec^{-1} b) 100 sec^{-1} c) 105 sec^{-1} d) 205 sec^{-1}

22. A body of mass M, executes vertical SHM with periods t_1, and t_2, when separately attached to spring A and spring B respectively. The period of SHM, when the body executes SHM. as shown in the figure is t_0. Then,



    a) $t_0^{-1} = t_1^{-1} + t_2^{-1}$ b) $t_0 = t_1 + t_2$ c) $t_0^2 = t_1^2 + t_2^2$ d) $t_0^{-2} = t_1^{-2} + t_2^{-2}$

23. A mass of 2.0 kg is put on a flat pan attached to a vertical spring fixed on the ground as shown in the figure. The mass of the spring and the pan is negligible. When pressed slightly and released the mass executes a simple harmonic motion. The spring constant is 200 N/m. What should be the minimum amplitude of the motion so that the mass gets detached from the pan (take g = 10 m/s^2)?

    a) 10.0 m b) Any value less than 12.0 cm c) 4.0 cm d) 8.0 sm

24. Four independent waves are represented by the following equations:
    $X_1 = a_1\sin\omega t \ldots (1)$; $X_2 = a_1\sin\ 2\omega t \ldots (2)$; $X_3 = a_1\sin\omega_1 t \ldots (3)$ *and* $X_4 = a_1\sin\ (\omega t + \delta) \ldots (4)$
    Interference is possible between waves represented by equations:
    a) 3 and 4 b) 1 and 2 c) 2 and 3 d) 1 and 4

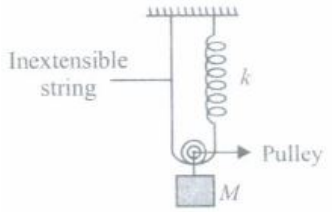
25. The piston in the cylinder head of a locomotive has a stroke of 6 m. If the piston executing simple harmonic motion with an angular frequency of 200 rad min^{-1}, its maximum speed is:
    a) 5 m s^{-1} b) 10 m s^{-1} c) 15 m s^{-1} d) 20 m s^{-1}

26. A particle executing SHM according to the equation $x = 5\cos\left(2\pi t + \frac{\pi}{4}\right)$ in units. The displacement and acceleration of the particle at t = 1.5 s is
    a) -3.0 m, 100 m s^{-2} b) +2.54 m, 200 m s^{-2} c) -3.54 m, 140 m s^{-2} d) +3.55 m, 120 ms^{-2}

27. The superposition takes place between two waves of frequency f and amplitude a. The total intensity is directly proportional to :
    a) a b) 2a c) $2a^2$ d) $4a^2$

28. The intensity of a plane progressive wave of frequency 1000 Hz is 10^{-10} watt per metre ^{2}. Given that the speed of sound is 330 m/s and density of air is 1.293kg/m^3, then the maximum change in pressure (in N/ m^2) is:
    a) $3x10^{-4}$ b) $3x10^{-5}$ c) $3x10^{-3}$ d) $3x10^{-2}$

29. The time period of mass M when displaced from its equilibrium position and then released for the system as shown in figure is



a) $2\pi\sqrt{\frac{M}{k}}$ b) $2\pi\sqrt{\frac{M}{2k}}$ c) $2\pi\sqrt{\frac{M}{4l}}$ d) $2\pi\sqrt{\frac{2M}{k}}$

30. A block of mass m is attached to a spring of spring constant k is free to oscillate with angular velocity ω in a horizontal plane without friction or clamping. It is pulled to a distance X_o and pushed towards the centre with a velocity v_0 at time t = O.The amplitude of oscillations in terms of ω , X_o and v_0 is:

a) $\sqrt{\frac{v_0^2}{\omega^2} - x_0^2}$ b) $\sqrt{\omega^2 v_0^2 + x_0^2}$ c) $\sqrt{\frac{x_0^2}{\omega^2} - v_0^2}$ d) $\sqrt{\frac{v_0^2}{\omega^2} - x_0^2}$

31. Two particles are oscillating along two close parallel straight lines side by side, with the same frequency and amplitudes. They pass each other, moving in opposite directions when their displacement is half of the amplitude. The mean positions of the two particles lie on a straight line perpendicular to the paths of the two particles. The phase difference is:
a) 0 b) 2π/3 c) P d) P/6

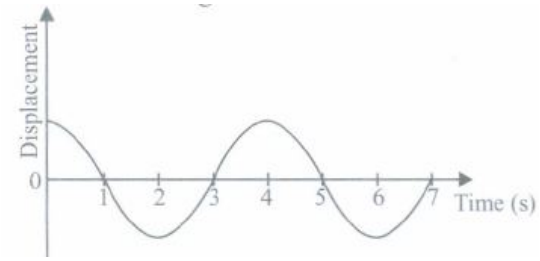
32. A wire is stretched between two rigid supports vibrates in its fundamental mode with a frequency of 50 Hz. The mass of the wire is 30 g and its linear density is 4 x 10-2 kg m S-I. The speed of the transverse wave at the string is
a) $25ms^{-1}$ b) $50ms^{-1}$ c) $75ms^{-1}$ d) $100ms^{-1}$

33. The displacement of a particle is given by x = 3 sin (5πt)+ 4 cos (5πt) The amplitude of particle is :
a) 3 b) 4 c) 5 d) 7

34. A body of mass m is situated in a potential field $U(x) = U_0(1 - cos\alpha x)$ where U_o and α are constants. The time period of small oscillations is

a) $2\pi\sqrt{\frac{m}{U_0\alpha}}$ b) $2\pi\sqrt{\frac{m}{U_0\alpha^2}}$ c) $2\pi\sqrt{\frac{m}{2U_0\alpha}}$ d) $2\pi\sqrt{\frac{2m}{U_0\alpha^2}}$

35. Displacement versus time curve for a particle SHM is as shown in the figure.



Which of the following statements is correct?
a) Phase of the oscillator is same at t = 0 s and t = 2 s.
b) Phase of the oscillator is same at t = 2 s and t = 5 s.
c) Phase of the oscillator is same at t = 1 s and t = 7 s
d) Phase of the oscillator is same at t = 1 s and t = 5 s.

36. The equation of motion of a particle is $x = a\cos\left(\alpha t^2\right)$. The motion is:
a) periodic but not oscillatory. b) periodic and oscillatory. c) oscillatory but not periodic
d) neither periodic nor oscillatory

37. The path difference between the two waves:
$y_1 = a_1\sin(\omega t - kx)$ and $y_2 = a_2\cos(\omega t - kx + \phi)$, *is*:

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

38. The equation of a travelling wave is, $y = 60\cos(1800t - 6x)$. Where y is in microns, t in seconds and x in metres. The ratio of maximum particle velocity to velocity of wave propagation is:
a) 3.6 b) 3.6x 10^{-6} c) 3.6x 10^{-11} d) 3.6x 10^{-4}

39. A person feels 2.5% difference of frequency of a motor-car horn. If the motor-car is moving to the person and the velocity of sound is 320 m/see, then the velocity of car will be :
a) 8 m/s (approx.) b) 800 m/s c) 7 m/s d) 6 m/s (approx)

40. Two pipes are each 50 cm in length. One of them is closed at one end while the other is open at both ends. The speed of sound in air is 340 m S^{-1}. The frequency at which both the pipes can resonate is
a) 680 Hz b) 510 Hz c) 85 Hz d) none of these

41. Assertion: On reflection from a rigid boundary there takes place a complete reversal of phase.
Reason: On reflection from a denser medium, both the particle velocity and wave velocity are reversed in sign.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

42. A stretched wire emits a fundamental note of 256 Hz. Keeping the stretching force constant and reducing the length of wire by 10 cm, the frequency becomes 320 Hz, the original length of the wire is:
a) 100 cm b) 50 cm c) 400 cm d) 200 cm

43. Mechanical waves on the surface of a liquid are:
a) transverse b) longitudinal c) torsional d) both transverse and longitudinal (or ripples)

44. A particle executing SHM. The phase difference between velocity and displacement is:
a) 0 b) $\frac{\pi}{2}$ c) π d) 2π

45. When two waves of almost equal frequencies V_1 and v_2 reach at a point simultaneously, the time interval between successive maxima is
a) v_1+v_2 b) v_1-v_2 c) $\frac{1}{v_1+v_2}$ d) $\frac{1}{v_1-v_2}$

46. A disc of radius R = 10 em oscillates as a physical pendulum about an axis perpendicular to the plane of the disc at a distance r from Its centre .If $r = \frac{R}{4}$ the approximate period of oscillation is (Takeg= 10 m s^{-2})
a) 0.84s b) 0.94s c) 1.26s d) 1.42s

47. The equation of a wave is represented by:
$y = 10^{-4}\sin\left[100t - \frac{x}{10}\right]$. The velocity of the wave will be _____ .
a) 100 m/s b) 250 m/s c) 750 m/s d) 1000 m/s

48. A glass tube of 1.0 m length is filled with water. The water can be drained out slowly at the bottom of the tube. If a vibrating tuning fork of frequency 500 Hz is brought at the upper end of the tube and the velocity of sound is 330 m S-I, then the total number of resonances obtained will be
a) 4 b) 3 c) 2 d) 1

49. Light can travel in vacuum but not sound, because:
    a) speed of sound is very much slower than light
    b) light waves are electromagnetic in nature c) sound waves are electromagnetic in nature
    d) light waves are not electromagnetic in nature

50. Sound waves of wavelength λ travelling in a medium with a speed of vms' enter 111 to another medium where its speed is 21' ms^{-1}. Wavelength of sound waves in the second medium is
    a) λ b) $\frac{\lambda}{2}$ c) 2λ d) 4λ

51. The speed of transverse wave on a stretched string is
    a) directly proportional to the tension in the string
    b) directly proportional to the square root of the tension c) inversely proportional to tension
    d) inversely proportional to square root of tension

52. An earthquake generates both transverse (5) and longitudinal (P) sound waves in the earth. The speed of 5 waves is about 4 km S^{-1} and that of P waves is about 8 km S^{-1}. A seismograph records P and 5 waves from an earthquake. The first P wave arrives 4 min before the first 5 wave. The epic entre of the earthquake is located at a distance of about
    a) 192 km b) 384 m c) 1920 km d) 384 km

53. If the amplitude of sound is doubled and the frequency reduced to one-fourth, the intensity of sound at the same point will:
    a) Increase by a factor of 2 b) Decrease by a factor of 2 c) Decrease by a factor of 4
    d) Remains unchanged

54. The second overtone of an open organ pipe has the same frequency as the first overtone of a closed pipe L metre long. The length of the open pipe will be:
    a) L b) 2L c) L/2 d) 4L

55. Two organ pipes give 4 beats when sounded together at 27^0C. Calculate the number of beats at 127^0C:
    a) 4.6 beats/sec b) 3.9 beats/sec c) 4 beats/sec d) none of these

56. In case of force oscillations of a body
    a) driving force is constant throughout. b) driving force is to be applied only momentarily
    c) driving force has to be periodic and continuous d) driving force is not required.

57. A block of mass 200 g executing SHM under the influence of a spring of spring constant k = 90 N m^{-1} and a damping constant b = 40 g s^{-1}.The time elapsed for its amplitude to drop to half of its initial value is (Given, In (1/2) = -0.693).
    a) 2.5 s b) 3.5 s c) 4.5 s d) 7.5 s

58. A string of 7m length has a mass of 0.035 kg. If tension in the string is 60.5 N, then speed of a wave on the string is _____ .
    a) 77 m/s b) 102 m/s c) 110 m/s d) 165 m/s

59. Equations of a stationary and a travelling waves are as follows:
    $y_1 = \text{a sin kx cos}\omega t$ and $y_2 = a\sin(\omega t - kx)$. The phase difference between two points $x_1 = \frac{\pi}{3k}$ and $x_2 = \frac{3\pi}{2k}$ and ϕ_1 and ϕ_2 respectively for the two waves. The ratio $(\phi_1/\phi_2)$is:
    a) 1 b) $\frac{5}{6}$ c) $\frac{3}{4}$ d) $\frac{6}{7}$

60. The displacement of a particle varies with time according to the relation y = a sin ωt + b cos ωt.
    a) The motion is oscillatory but not SHM. b) The motion is SHM with amplitude a + b.
    c) The motion is SHM with amplitude a^2+b^2 d) The motion is SHM with amplitude $\sqrt{a^2+b^2}$

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

a) $2v$ b) $\left(\sqrt{3}/2\right)v$ c) $\left(2/\sqrt{3}\right)v$ d) $v/2$

62. The shape of the wave at any fixed instant, say t = t_o is given by:
a) function of x only b) function of t only c) a function which represents sine wave
d) both (a) and (c)

63. The speed of a wave in a medium is 760 m/s.If 3600 waves are passing through a point in the medium in 2 min, then their wavelength is _____ .
a) 13.8 m b) 25.3 m c) 41.5 m d) 57.2 m

64. A man stands between two parallel cliffs (not in middle). When he claps his hands, he hears two echoes one after 1 second and the other after 2 seconds. If the velocity of sound in air is 330 m s^{-1} the width of the valley is:
a) 330 m b) 495 m c) 660 m d) 990 m

65. Which of the following waves does not travel in vacuum?
a) Seismic waves b) X-rays c) Light d) Radio waves

66. Two simple harmonic motions are represented by the equations.

$$y_1 10\sin\frac{\pi}{4}(12t+1), y_2 5\left(\sin 3pt + \sqrt{3}\cos 3pt\right)$$

The ratio of their amplitudes is
a) 1: 1 b) 1: 2 c) 3: 2 d) 2: 3

67. A travelling wave is partly reflected and partly transmitted from a rigid boundary. Let a_i, a_r and a_t be the amplitudes of incident wave, reflected wave and transmitted wave and I_i, I_r and I_t be the corresponding intensities. Then, choose the correct alternative:

a) $\frac{I_i}{I_r} = \left(\frac{a_i}{a_r}\right)^2$ b) $\frac{I_i}{I_t} = \left(\frac{a_i}{a_t}\right)^2$ c) $\frac{I_r}{I_t} = \left(\frac{a_r}{a_t}\right)^2$ d) all of these

68. A blast gives a sound of intensity 0.8 W/m^2 and frequency 1kHz. If the density of air is 1.3 kg/m^3 and speed of sound in air is 330 m/s, the amplitude of the sound wave is approximately:
a) 5 x 10^{-6} m b) 9.7 x 10^{-6} m c) 15 x 10^{-6} m d) 20 x 10^{-6} m

69. The phase difference between the instantaneous velocity and acceleration of a particle executing simple harmonic motion is:
a) p b) 0707p c) zero d) 0.5p

70. When beats are produced by two progressive waves of nearly the same frequency, which one of the following is correct?
a)
The particles vibrate simple harmonically, with the frequency equal to the difference in the component frequencies
b)
The amplitude of vibrations at any point changes simple harmonically with a frequency equal to difference in the frequencies of the two waves
c) The frequency of the beats depends on the position, where the observer is
d) The frequency of the beat changes as the time progresses
e) The particle's vibration frequency and amplitude frequency are equal

71. When beats are produced by two progressive waves of the same amplitude and of nearly the same frequency, the ratio maximum loudness to the loudness of one of the waves will be n, where n is:
a) 3 b) 1 c) 4 d) 2

72. The period of oscillation of a mass M suspended from a spring of negligible mass is 7. If along with it another mass M is also suspended, the period of oscillation will now be:
a) T b) $T\sqrt{2}$ c) 2T d) $\sqrt{2}T$

73. A whistle of frequency 385 Hz rotates in a horizontal circle of radius 50 cm at an angular speed of 20 radians s^{-1}. The lowest frequency heard by a listener a long distance away at rest with respect to the centre of the circle, (given velocity of sound equal to $340\ \text{ms}^{-1}$), is _____ .
a) 396 Hz b) 363 Hz c) 374 Hz d) 385 Hz

74. Two men stand a certain distance apart beside a long metal fence on a still day; one man places his ear against the fence while the other gives the fence a sharp knock with a hammer. Two sounds separated by a time interval of 0.5 second are heard by the first man. If the velocity of sound in air is 330 m s^{-1} and in the metal is 5280 m s^{-1}, how far apart are the men?
a) 352 m b) 330 m c) 165 m d) 176 m

75. Which of the following statements is true for wave motion?
a) Mechanical transverse waves can propagate through all mediums
b) Longitudinal waves can propagate through solids only.
c) Mechanical transverse waves can propagate through solids only
d) Longitudinal waves can propagate through vacuum.

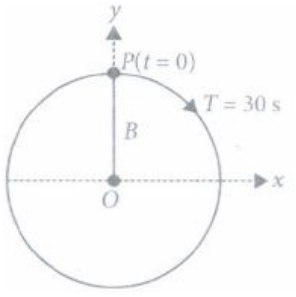
76. Which of the following statements is incorrect for a stationary wave?
a)
Every particle has a fixed amplitude which is different from the amplitude of its nearest particle.
b) All the particles cross their mean position at the same time.
c) All the particles are oscillating with same amplitude.
d) There is no net transfer of energy across any plane.

77. A racing car moving towards a cliff sounds its horn. The driver observes that the sound reflected from the cliff has a pitch one octave higher than the actual sound of the horn. If v is the velocity of sound, then the velocity of the car is:
a) $\frac{v}{2}$ b) $\frac{v}{\sqrt{2}}$ c) $\frac{v}{4}$ d) $\frac{v}{3}$

78. When two progressive waves of intensity I_1 and I_2 but slightly different frequencies superpose, the resultant intensity fluctuates between:
a) $\left(\sqrt{I_1}+\sqrt{I_2}\right)^2$ and $\left(\sqrt{I_1}-\sqrt{I_2}\right)^2$ b) $\left(\sqrt{I_1}+\sqrt{I_2}\right)$ and $\left(\sqrt{I_1}-\sqrt{I_2}\right)$ c) $\left(I_1+I_2\right)$ and $\sqrt{I_1-I_2}$
d) $\frac{I_1}{I_2}$ and $\frac{I_2}{I_1}$

79. Two sources of sound placed close to each other are emitting progressive waves given by y_1 = 4 sin 600 pt and y_2 = 5 sin 608 pt. An observer located near these two sources of sound will hear:
a) 4 beats per second with intensity ratio 25= 16 between waxing and waning.
b) 8 beats per second with intensity ratio 25: 16 between waxing and waning
c) 8 beats per second with intensity ratio 81: 1 between waxing and waning
d) 4 beats per second with intensity ratio 81: 1 between waxing and waning

80. Figure shows the circular motion of a particle. The radius of the circle, the period, sense of revolution and the initial position are indicated on the figure. The simple harmonic motion of the x-projection of the radius vector of the rotating particle P is



a) $x(t) = B\sin\left(\frac{2\pi}{30}t\right)$ b) $x(t) = B\cos\left(\frac{\pi}{15}t\right)$ c) $x(t) = B\sin\left(\frac{\pi}{15}t+\frac{\pi}{2}\right)$ d) $x(t) = B\cos\left(\frac{\pi}{15}t+\frac{\pi}{2}\right)$

81. 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) figures of eight b) straight line c) ellipse d) circle

82. When a string is divided into three segments of length l_1, l_2 and l_3 the fundamental frequencies of these three segments are v_1, v_2 and v_3 respectively. The original fundamental frequency (v) of the string is:
a) $\sqrt{v} = \sqrt{v_1} + \sqrt{v_2} + \sqrt{v_3}$ b) $v = v_1 + v_2 + v_3$ c) $\frac{1}{v} = \frac{1}{v_1} + \frac{1}{v_2} + \frac{1}{v_3}$ d) $\frac{1}{\sqrt{v}} = \frac{1}{\sqrt{v_1}} + \frac{1}{\sqrt{v_2}} + \frac{1}{\sqrt{v_3}}$

83. A simple pendulum has a metal bob, which is negatively charged. If it is allowed to oscillate above a positively charged metallic plate, then its time period will
a) increase b) decrease c) become zero d) remain the same

84. A body is executing SHM. When the displacement from the mean position is 4 cm and 5 cm, the corresponding velocities of the body is 10 cm/s and 8 cm/s. Then, the time period of the body is:
a) 2πsec b) $\frac{\pi}{2}$sec c) πsec d) $\frac{3\pi}{2}$sec

85. In a transverse wave, the particles of the medium
a) vibrate in a direction perpendicular to the direction of the propagation.
b) vibrate in a direction parallel to the direction of of the propagation. c) move in circle.
d) move in ellipse

86. Ultrasonic, infrasonic and audio waves travel through a medium with speed V_u ,V_i and Va respectively; then:
a) V_u ,V_i and V_a are nearly equal b) $V_u \geq V_a \geq V_i$ c) $V_u \leq V_a \leq V_i$ d) $V_a \leq V_u$ and $V_u \approx V_i$

87. A train, standing in a station yard, blows a whistle of frequency 400 Hz in still air. The wind starts blowing in the direction from the yard to the station with a speed of 10m S^{-1}. Which of the following statements is correct?
(Speed of sound in still air is 340 m S^{-1})
a) The frequency of sound as heard by an observer standing on the platform is 400 Hz.
b) The speed of sound for the observer standing on the platform is 330 m S^{-1}.
c) The frequency of sound as heard by the observer standing on the platform will increase.
d) The frequency of sound as heard by the observer standing on the platform will decrease.

88. There is a body having mass m and performing S.H.M. with amplitude a. There is a restoring force F = -kx. The total energy of body depends upon
a) k, x b) k, a c) k, a, x d) k, a, v

89. Velocity of sound in vacuum is
a) zero b) 330 m S^{-1} c) 360 m S^{-1} d) 660 m S^{-1}

90. If the maximum velocity and acceleration of a particle executing SHM are equal in magnitude, the time period will be
a) 1.57 sec b) 1.57 sec c) 6.28 sec d) 12.56 sec

91. In the following question, a statement of assertion is followed by a statement of reason. Mark the correct choice as :
Assertion: Simple harmonic motion is the projection of uniform circular motion on the diameter of the circle in which the latter motion occurs.
Reason : Simple harmonic motion is a uniform motion
a) If both assertion and reason are true and reason is the correct explanation of assertion
b) If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false d) If both assertion and reason are false.

92. Two waves are represented by the equations
Y1 = asin(ωt + kx + 0.57) m and
Y2 = acos(ωt + kx) m,

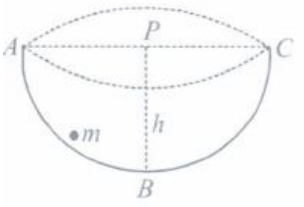
where x is in metres and t is in seconds. The phase difference between them is
a) 1.0 radian b) 1.25 radian c) 1.57 radian d) 0.57 radian

93. A particle oscillating under a force $\vec{F} = -k\vec{x} - b\vec{v}$ is a (k and b are constants)
a) simple harmonic oscillator b) linear oscillator c) damped oscillator d) forced oscillator

94. Consider a pair of identical pendulums, which oscillate with equal amplitude independently such that when one pendulum is at its extreme position making an angle of 20 to the right with the vertical, the other pendulum makes an angle of 10 to the left of the vertical. The phase difference between the pendulums is

a) $\frac{\pi}{2}$ b) $\frac{2}{3}\pi$ c) $\frac{3}{2}\pi$ d) π

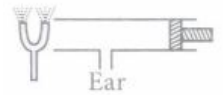
95. A sphere of mass m makes SHM in a hemispherical bowl ABC and it moves from A to e and back to A via ABC, so that PB = 17. If acceleration due to gravity is g the speed of the ball when it just crosses the point B is



a) 2gh b) mgh c) $\sqrt{2gh}$ d) $\frac{gh}{2}$

96. If a simple harmonic oscillator has got a displacement of 0.02 m and acceleration equal to 2.0 m/s^2 at any time, the angular frequency of the oscillator is equal to _____ .
a) 10 rad/s b) 0.1 rad/s c) 100 rad/s d) 1 rad/s

97. A vibrating tuning fork of frequency u is placed near the open end of a long cylindrical tube. The tube has a side opening and is also fitted with a movable reflecting piston. As the piston is moved through 8.75 cm, the intensity of sound changes from a maximum to minimum. If the speed of sound is 350 m s^{-1}, then υ is



a) 500 Hz b) 1000 Hz c) 2000 Hz d) 4000 Hz

98. A string of mass 2.5 kg is under a tension of 200 N. The length of the stretched string is 20 m. If the transverse jerk is struck at one end of the string, the disturbance will reach the other end in
a) one second b) 0.5 second c) 2 second d) data given is insufficient.

99. The transverse displacement of a string clamped at its both ends is given by y(x, t) = 2sin

$$\left(\frac{2\pi}{3}x\right)cos(100\pi t).$$

where x and yare in cm and t is in s. Which of the following statements is correct?
a)
All the points on the string between two consecutive nodes vibrate with same frequency, phase and amplitude.
b)
All the points on the string between two consecutive nodes vibrate with same frequency and phase but different amplitude,

c)
All the points on the string between two consecutive nodes vibrate with different frequency and phase but same amplitude.
d)
All the points on the string between two consecutive nodes vibrate with different frequency, phase and amplitude.

100. A particle is acted simultaneously by mutually perpendicular simple harmonic motions x = a cos ω t and y = a sin ωt. The trajectory of motion of the particle will be
a) an ellipse b) a parabola c) a circle d) a straight line.

101. Of the following gases, velocity of sound at 30° C will be least through:
a) N_2 b) O_2 c) SO_2 d) CO_2

102. A particle, with restoring force proportional to displacement and resisting force proportional to velocity is subjected to a force F sin wt. If the amplitude of the particle is maximum for $w = w_1$ and the energy of the particle is maximum for $w = w_2$, then:
a) $w_1 = w_0$ and $w_2 {}^1 w_0$ b) $w_1 = w_0$ and $w_2 = w_0$ c) $w_1 {}^1 w_0$ and $w_2 = w_0$ d) $w_1 {}^1 0$ and $w_2 {}^1 w_0$

103. Which of the following is not the standard form of a sine wave?
a) $y = A\sin 2\pi\left(\frac{t}{T} - \frac{x}{\lambda}\right)$ b) $y = A\sin(vt - kx)$ c) $y = A\sin\omega\left(t - \frac{x}{v}\right)$ d) $y = A\sin k(vt - x)$

104. A particle executes simple harmonic oscillation with an amplitude a. The period of oscillation is 7. The minimum time taken by the particle to travel half of the amplitude from the equilibrium position is:
a) T/8 b) T/12 c) T/2 d) T/4

105. 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 frequency 2f. If v be the velocity of sound, then the velocity of the car, in the same velocity units, will be:
a) v/2 b) $v/\sqrt{2}$ c) v/3 d) v/4

106. A source of sound of frequency 600 Hz is placed inside water. The speed of sound in water is 1500 m/s and in air it is 300 m/s. The frequency of sound recorded by an observer who is standing in air is:
a) 200 Hz b) 3000 Hz c) 120 Hz d) 600 Hz

107. A sound source is moving towards a stationary observer with 1/10 of the speed of sound. The ratio of apparent to real frequency is :
a) 10/9 b) 11/10 c) $(11/10)^2$ d) $(9/10)^2$

108. 41 tuning forks are arranged such that every fork gives 5 beats with the next. The last fork has a frequency that is double of the first. The frequency of the first fork is:
a) 200 b) 400 c) 205 d) 210

109. $y = a\cos(kx + \omega t)$superposes on another wave giving a stationary wave having node at x = 0.What is the equation of the other wave?
a) $a\cos(kx + \omega t)$ b) $a\cos(kx - \omega t)$ c) $-a\cos(kx + \omega t)$ d) $-a\sin(kx + \omega t)$

110. If the resultant amplitude due to superposition of two waves changes periodically with time as well as in position, then it is a case of:
a) interference b) beats c) stationary waves d) Lissajous' figures

111. The amplitude of a wave is given by: $A = \frac{c}{(a+b-c)}$. Resonance will occur when:
a) b=-c/2 b) b=-a/2 c) b=0,a=c d) none of these

112. Oxygen is 16 times heavier than hydrogen. The equal volumes of hydrogen and oxygen are mixed. The ratio of speed of sound in the mixture to that in hydrogen is:
a) $\sqrt{8}$ b) $\sqrt{\frac{1}{8}}$ c) $\sqrt{\frac{2}{17}}$ d) $\sqrt{\frac{32}{17}}$

113. A sound wave has frequency 500 Hz and velocity 360 m/sec. What is the distance between two particles having phase difference of 60^0?
a) 0.7 cm b) 12.0 cm c) 70 cm d) 120.0 cm

114. In a progressive wave along X-direction, at a particular location, the particles of the medium are executing:
a) oscillatory motion b) rectilinear motion c) rotational motion d) none of these

115. Assertion: In a sound wave, a displacement node is a pressure antinode and vice versa.
Reason: Displacement node is a point of minimum displacement.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

116. A mass m is suspended from a string of length l and force constant k. The frequency of vibration of the mass is f_1. The spring is cut in to two equal parts and the same mass is suspended from one of the parts. The new frequency of vibration of mass is f_2 Which of the following reaction between the frequencies is correct.
a) $f_1 = \sqrt{2}\, f_2$ b) $f_1 = f_2$ c) $f_1 = 2f_2$ d) $f_2 = \sqrt{2} f_1$

117. Two waves are represented by: $y_1 = 4\sin 404\pi t$ and $y_2 = 3\sin 404\pi t$. Then:
a) beat frequency is 4 Hz and the ratio of maximum to minimum intensity is 49 : 1
b) beat frequency is 2 Hz and the ratio of maximum to minimum intensity is 49 : 1
c) beat frequency is 2 Hz and the ratio of maximum to minimum intensity is 1 : 49
d) beat frequency is 4 Hz and the ratio of maximum to minimum intensity is 1 : 49

118. An echo repeats 2 syllables. If the speed of sound is 330 m s^{-1}, then the distance of the reflecting surface is:
a) 16.5 m b) 33.0 m c) 66.0 m d) 99.0 m

119. In a certain oscillatory system, the amplitude of motion is 5 m and the time period is 4 s. The time taken by the particle for passing between points which are at distances of 4 m and 2 m from the centre and on the same side of it will be
a) 0.30 s b) 0.32 s c) 0.33 s d) 0.35 s

120. Two trains move towards each other with the same speed. The speed of sound is 340 m/s. If the height of the tone of the whistle of one of them heard on the other changes 9/8 times, then the speed of each train should be:
a) 20 m/s b) 2 m/s c) 200 m/s d) 2000 m/s

121. The damping force on an oscillator is directly proportional to the velocity. The units of the constant of proportionality are:
a) $kgms^{-1}$ b) $kgms^{-2}$ c) kgs^{-1} d) kgs

122. Find the temperature at which the fundamental frequency of an organ pipe is independent of small variation in temperature in terms of the coefficient of linear expansion (ex) of the material of the tube.
a) 1/5 b) 1/3 c) 1/2 d) 1/4

123. Which of the following statement is wrong?
a) Changes in air temperature have no effect on the speed of sound
b) Changes in air temperature have effect on the speed of sound
c) The speed of sound in water is lower than in air d) Both 'a' and 'c'

124. A simple pendulum of length L and having a bob of mass 111 is suspended in a car. The car is moving on.1 circular track of radius R with a uniform speed v. If the pendulum makes small oscillations in a radial direction about its equilibnum position, its time pen d of oscillation is

a) $T = 2\pi\sqrt{\frac{L}{g}}c$ b) $T = 2\pi\sqrt{\frac{L}{\sqrt{g^2 + \frac{v^4}{R^2}}}}$ c) $T = 2\pi\sqrt{\frac{L}{\sqrt{g^2\frac{v^2}{R}}}}$ d) $T = 2\pi\sqrt{\frac{L}{g^2 - \frac{v^4}{R^2}}}$

125. The Halley's comet appears after every
a) 72 years b) 74 years c) 76 years d) 78 years

126. A siren can be made from a rotating flat disc, which has regularly spaced holes punched through it along a circle concentric with the axis of rotation. An air nozzle is directed against the disc. Each time a hole passes the nozzle, a puff of air is released to generate a wave pulse. Sound of what frequency will be produced by disc containing 72 holes and rotating at 1800 rev/min?
a) 72 x 1800Hz b) 72 x 1800 x 60Hz c) 2160 Hz d) 72 Hz

127. The propagation constant of a wave is also called its
a) wavelength b) frequency c) wave number d) angular wave number

128. In an SHM, x is the displacement and a is the acceleration at time t. The plot of a against x for one complete oscillation will be
a) a straight line b) a circle c) an ellipse d) a sinusoidal curve

129. 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

130. The time period of a simple pendulum on the surface of the earth is 4 s. Its time period on the surface of the moon is
a) 4 s b) 8 s c) 10 s d) 12 s

131. The time period of a mass suspended from a spring is T. If the spring is cut into four equal parts and the same mass is suspended from one of the parts, then the new time period will be:
a) 2T b) $\frac{T}{4}$ c) 2 d) $\frac{T}{2}$

132. I here are 26 tuning forks arranged in the decreasing order of their frequencies. Each tuning fork gives 3 beats with the next. The first one is octave of the last. What IS the frequency of 18th tuning fork?
a) 100 Hz b) 99 Hz c) 96 Hz d) 103 Hz

133. The displacement of a particle is represented by the equation $y = 3cos\left(\frac{\pi}{4} - 2\omega t\right)$.The motion of the particle is
a) simple harmonic with period $\frac{2\pi}{\omega}$ b) simple harmonic with period $\frac{\pi}{\omega}$
c) periodic but not simple harmonic d) non-periodic.

134. The kinetic energy of a particle executing SHM is 16 J when it is in its mean position. If the amplitude of oscillation is 25 cm and mass of the particle is 5.12 kg, the time period of its oscillation is:
a) (π/5)sec b) 2πsec c) 20πsec d) 5πsec

135. In a stationary wave:
a) energy is uniformly distributed
b) energy is maximum at nodes and minimum at antinodes
c) energy is minimum at nodes and maximum at antinodes
d) alternating maxima and minima of energy are produced at nodes and antinodes

136. Which of the following expressions does not represent SHM?
a) A cos ωt b) A sin ωt c) sin ωt + B cosωt d) A sin ^{2} ωt

137. A number of tuning forks are arranged in the order of increasing frequency and any two successive tuning forks produce 4 beats per second, when sounded together. If the last tuning fork has a frequency octave higher than that of the first tuning fork and the frequency of the first tuning fork is 256 Hz, then the number of tuning forks is:
a) 63 b) 64 c) 65 d) 66

138. A mass m is vertically suspended from a spring of negligible mass, the system oscillates with a frequency n. What will be the frequency of the system, if amass 4m is suspended from the same spring?
a) $\frac{n}{4}$ b) 4n c) $\frac{n}{2}$ d) 2n

139. When a longitudinal wave propagates through a medium, the particles of the medium execute simple harmonic oscillations about their mean positions. These oscillations of a particle are characterised by an invariant:
a) kinetic energy b) potential energy c) sum of kinetic energy and potential energy
d) difference between kinetic energy and potential energy

140. Which of the following statements is correct for stationary waves?
a) Nodes and antinodes are formed in case of stationary transverse wave only.
b)
In case of longitudinal stationary wave, compressions and rarefactions are obtained in place of nodes and antinodes respectively
c)
Suppose two plane waves, one longitudinal and the other transverse having same frequency and amplitude are travelling in a medium in opposite directions with the same speed, by superposition of these waves, stationary waves cannot be obtained.
d) None of the above.

141. At a fixed instant, say t = t_o, the argument of the sine function in y(x, t) is:
a) having constant + kx b) having constant - kx c) $kx - \omega t_0 + \phi$ d) both (a) and (c)

142. Speed of sound waves in a fluid is
a) directly proportional to the square root of bulk modulus of the medium.
b) inversely proportional to the bulk modulus of the medium.
c) directly proportional to the density of the medium.
d) inversely proportional to the density of the medium.

143. Two simple harmonic motions with the same frequency act on a particle at right angles i.e., along X-axis and Y-axis. If the two amplitudes are equal and the phase difference is p/2, the resultant motion will be _____ .
a) a circle b) an ellipse with the major axis along Y-axis
c) an ellipse with the major axis along X-axis d) a straight line inclined at 45^o to the X-axis

144. If the string is very large compared to the size of the pulse, then which of the given statements is correct?
a) The pulse will reach the other end and gets reflected from the wall
b) The pulse will damp out before it reaches the other end
c) The pulse will get reflected from the wall to the other end and then damp out gradually
d) Both (a) and (b)

145. The displacement of a particle executing simple harmonic motion is given by

$x = 3\sin\left(2\pi t + \frac{\pi}{4}\right)$ where x is in metres and t is in seconds. The amplitude and maximum speed of the particle is

a) 3m,2π ms^{-1} b) 3m,4π ms^{-1} c) 3 m, 6πm s^{-1} d) 3 m, $8\pi ms^{-1}$

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

a) y=sin(2πx+2πt) b) y=sin(x-2t) c) y=sin(2πx-2πt) d) y=sin(10πx-20πt)

147. Two waves are said to be coherent, if they have _____ .

a) Same phase but different amplitude b) Same frequency but different amplitude

c) Same frequency, phase and amplitude d) Different frequency, phase and amplitude

148. Two solid bars are having Young's modulus Y_1 and Y_2 in the ratio (Y_1 / Y_2) = 4. If the bars are made up of the material with same density, then the ratio of the speed of longitudinal waves in the solid bars, i.e., (v_1/v_2) is:

a) 2 b) 1 c) 3 d) 4

149. Two points on a travelling wave having frequency 500 Hz and velocity 300 m/s are 60° out of phase, then the minimum distance between the two points is:

a) 0.2 b) 0.1 c) 0.5 d) 0.4

150. A tuning fork of frequency 440 Hz resonates with a tube closed at one end of length 1.8 cm and diameter 5 cm in fundamental mode. The velocity of sound in air is:

a) 336 m S^{-1} b) 343 m S^{-1} c) 300 m S^{-1} d) 350 m S^{-1}

151. The speed of sound in air at a given temperature is 350 m/s. An engine blows whistle at a frequency of 1200 cps. It is approaching the observer with velocity 50 m/s. The apparent frequency in eps heard by the observer will be :

a) 600 b) 1050 c) 1400 d) 2400

152. Two waves are given by: $y_1 = \cos(4t - 2x)$ and $y_2 = \sin\left(4t - 2x + \frac{\pi}{4}\right)$. The phase difference between the two waves is:

a) $\frac{\pi}{4}$ b) $-\frac{\pi}{4}$ c) $\frac{3\pi}{4}$ d) $\frac{\pi}{2}$ e) $\frac{3\pi}{2}$

153. The equation$y = a\sin 2\pi\left(\frac{t}{T} - \frac{x}{\lambda}\right)$ of a simple harmonic wave gives us:

a) the displacement of all particles of the medium at a particular instant of time only

b) the displacement of a single particle at any time

c)
the displacement of all the particles of the medium at a particular instant of time as well as the displacement of a single particle at any time

d) the behaviour of the medium as a whole

154. A string of mass 3 kg is under tension of 400 N. The length of the stretched string is 25 cm. If the transverse jerk is stuck at one end of the string how long does the disturbance take to reach the other end?

a) 0.043 s b) 0.055 s c) 0.034 s d) 0.065 s

155. A progressive wave is represented by
y = 5 sin(10πt - 2πx) where x and y are in m and t is in s. The maximum particle velocity is

a) 100π m S^{-1} b) 200π m S^{-1} c) 400π m S^{-1} d) 500π m S^{-1}

156. When stationary waves are produced in a medium, which physical characteristics change at antinodes?

a) Density only b) Pressure only c) Density and pressure

d) Neither density nor pressure

157. An astronaut cannot hear his companion at the surface of the moon because:

a) produced frequencies are above the audio frequencies

b) there is no medium for sound propagation

c) temperature is too low during night and high during day

d) there are too many craters on the surface of the moon

158. A stone is dropped into a pond from the top of the tower of height h. If v is the speed of sound in air, then the sound of splash will be heard at the top of the tower after a time:

a) $\sqrt{\frac{2h}{g}} + \frac{h}{v}$ b) $\sqrt{\frac{2h}{g}} - \frac{h}{v}$ c) $\sqrt{\frac{2h}{g}}$ d) $\sqrt{\frac{2h}{g}} + \frac{2h}{v}$

159. Assertion: When a source of sound passes us, whether it be a car horn or a train whistle, the pitch we hear goes from high to low.

Reason: According to Doppler's effect, there is apparent change in the frequency of sound observed due to relative motion between the observer and the source of sound.

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

160. Three travelling waves in same direction are superimposed. The equations of wave are $y_1=A_o$ $y_1 = A_o sin(kx - \omega t)$,$y_2 = 3\sqrt{2}A_0 sin(kx - \omega t + \phi)$ and $y_3 = 4A_o cos(kx - \omega t)$. If $0 \le \phi \le \pi/2$ and the phase difference between resultant wave and first wave is $\pi/4$,then ϕ is

a) $\frac{\pi}{6}$ b) $\frac{\pi}{3}$ c) $\frac{\pi}{12}$ d) none of these

161. It is found that an increase in pressure of 100 KP a causes a certain volume of water to decrease by 5 x 10^{-3} percent of its original volume. Then, the speed of sound in water is about:

a) 330 m/s b) 1400 m/s c) 2400 m/s d) 660 m/s

162. Transverse elastic waves can propagate:

a) both in a gas and a metal b) in a gas but not in a metal c) in a metal but not in a gas

d) neither in a gas nor in a metal

163. 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 = 340m/s)

a) 4 b) 5 c) 7 d) 6

164. The following equations represent progressive transverse waves:

$z_1 = A\cos(\omega t - kx); z_2 = A\cos(\omega t + kx); z_3 = A\cos(\omega t - ky)$ and $z_4 = A\cos(2\omega t - 2ky)$. A stationary wave will be formed by superposing:

a) z_1 and z_2 b) z_1 and z_4 c) z_2 and z_3 d) z_3 and z_4

165. Equation of progressive wave is given by

$$y = 4\sin\left[\pi\left(\frac{t}{5} - \frac{x}{9}\right) + \frac{x}{6}\right]$$

Then, which of the following is correct?

a) $v = 5$ cm b) $\lambda = 18$ cm c) $a = 0.04$ cm d) $f = 50$ Hz

166. A transverse harmonic wave on a string is described by y(x, t) = 3sin $\left(36t + 0.018x + \frac{\pi}{4}\right)$ where x and yare in cm and t is in s. Which of the following statements is incorrect?

a) The wave is travelling in negative x-direction b) The amplitude of the wave is 3 cm.

c) The speed of the wave is 20 m S^{-1}. d) The frequency of the wave is $\frac{9}{\pi}$Hz.

167. In the following question, a statement of assertion is followed by a statement of reason. Mark the correct choice as :
Assertion: In forced oscillations, the steady state motion of the particle is simple harmonic.
Reason : The frequency of particle after the free oscillations die out, is the natural frequency of the particle.
a) If both assertion and reason are true and reason is the correct explanation of assertion
b) If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false d) If both assertion and reason are false

168. 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 sec when the tension in the piano string increased. The frequency of the piano string before increasing the tension was _____ .
a) 510 Hz b) 514 Hz c) 516 Hz d) 508 Hz

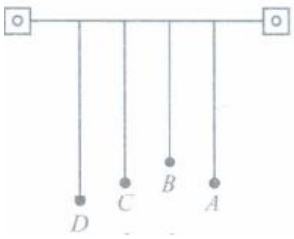
169. In stationary waves, antinodes are the points where
a) Minimum displacement and minimum pressure change occur
b) Minimum displacement and maximum pressure change occur
c) Maximum displacement and maximum pressure change occur
d) Maximum displacement and minimum pressure change occur

170. At the nodes of a longitudinal stationary wave:
a) the amplitude of oscillation is maximum b) the density variation is zero
c) the pressure variation is maximum d) the velocity amplitude is maximum

171. The following equations represent transverse waves:
$z_1 = A\cos(kx - \omega t); z_1 = A\cos(kx + \omega t)$ and $z_3 = A\cos(kx - \omega t)$, then the combination of waves which can produce stationary wave is:
a) z_1 and z_2 b) z_1 and z_3 c) z_2 and z_2 d) z_1, z_1 and z_3

172. The displacement of a particle executing periodic motion is given by:
$y = 4\cos^2(t/2)\sin(1000\quad t)$. This expression may be considered to be a result of superposition of:
a) two waves b) three waves c) four waves d) five waves

173. Four pendulums A, B, C and D are suspended from the same elastic support as shown in figure. A and C are of the same length, while B is smaller than A and D is D C larger than A. If A is given a transverse displacement,



a) D will vibrate with maximum amplitude b) C will vibrate with maximum amplitude
c) B will vibrate with maximum amplitude d) All the four will oscillate with equal amplitude

174. The relation between acceleration and displacement of four particles are given below
Which one of the particles is executing simple harmonic motion?
a) $a_x = +2x$ b) $a_x = +2X^2$ c) $a_x = -2X^2$ d) $a_x = -2x$

175. Which one of the following is a simple harmonic motion?
a) Ball bouncing between two rigid vertical walls
b) Particle moving in a circle with uniform speed
c) Wave moving through a string fixed at both ends d) Earth spinning about its own axis.

176. Compressional wave pulses are sent to the bottom of sea from a ship and the echo is heard after 2 s. If bulk modulus of elasticity of water is 2 x 10^9 N/m^2 and mean temperature is 4°C, the depth of the sea will be:
a) 1014 m b) 1414 m c) 2828 m d) none of these

177. Two point isotropic sound sources A and B emitting waves of equal frequency with equal power are located in a medium, some distance apart. A long line AB:
a) a stationary wave is established between A and B
b)
though stationary wave is not formed but nodes and antinodes are formed between A and B
c) superposition of two waves is impossible between A and B d) none of the above

178. In a simple harmonic motion, when the displacement is one-half the amplitude, what fraction of the total energy is kinetic?
a) Zero b) $\frac{1}{4}$ c) $\frac{1}{2}$ d) $\frac{3}{4}$

179. A train standing at the outer signal of a railway station blows a whistle of frequency 400 Hz in still air. The train begins to move with a speed of 30 m S^{-1} towards the platform. The frequency of the sound heard by an observer standing on the platform is (Speed of sound in air = 330 m S^{-1})
a) 420 Hz b) 430 Hz c) 440 Hz d) 450 Hz

180. In a plane progressive wave given by: y = 25cos(2πt − πx), the amplitude and frequency are respectively:
a) 25, 100 b) 25, 1 c) 25, 2 d) 50π, 2

181. An auditorium has volume $10^5 m^3$ and surface area of absorption 2 x 10^4 m^2 . Its average absorption coefficient is 0.2. The reverberation time of the auditorium (in seconds) is:
a) 6.5 b) 5.5 c) 4.25 d) 3.25

182. The phenomenon of echo is an example of:
a) reflection b) refraction c) beats d) resonance

183. A block of mass M is attached to the lower end of a vertical spring. The spring is hung from a ceiling and has force constant value k. The mass is released from rest with the spring initially unstretched. The maximum extension produced in the length of the spring will be:
a) 2 Mg/k b) 4 Mg/k c) Mg/2k d) Mg/k

184. Beats are produced with the help of two sound waves on amplitude 3 and 5 units. The ratio of maximum to minimum intensity in the beats is :
a) 2:1 b) 5:3 c) 4:1 d) 16:1

185. A speeding motorcyclist sees traffic jam ahead of him. He slows down to 36 km/hour. He finds that traffic has eased and a car moving ahead of him at 18 km/hour is honking at a frequency of 1392 Hz. If the speed of sound is 343 m/s, the frequency of the honk as heard by him will be:
a) 1332 Hz b) 1372 Hz c) 1412 Hz d) 1454 Hz

186. The net displacement of the waves is given by the principle of superposition as

$y(x, t) = A(\phi)\sin\left(kx - \omega t + \frac{\phi}{2}\right)$ which of the following statements is correct for the resultant wave?

(I) The resultant wave y(x, t)is a harmonic wave travelling in the positive direction of x-axis as the constituent waves.
(II) The resultant wave has different frequency and wavelength than the constituent waves.
(III) Initial phase angle is $\frac{\phi}{2}$. Choose the correct option from those given below:
a) I and III b) only II c) II and III d) I ,II and III

187. 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 is:
a) a b) 2a c) 8a d) 16a

188. The length of the wire between two ends of a sonometer is 100 cm. What should be the positions of two bridges below the wire so that the three segments of the wire have their fundamental frequencies in the ratio of 1: 3: 5?
a) $\frac{1500}{23}$ cm, $\frac{2000}{23}$ cm b) $\frac{1500}{23}$ cm, $\frac{500}{23}$ cm c) $\frac{1500}{23}$ cm, $\frac{300}{23}$ cm d) $\frac{300}{23}$ cm, $\frac{1500}{23}$ cm

189. Two wires are in unison. If the tension in one of the wires is increased by 2%, 5 beats are produced per second. The initial frequency of each wire is:
a) 200 Hz b) 400 Hz c) 500 Hz d) 1000 Hz

190. A tuning fork gives 4 beats with 50 cm length of a sonometer wire. If the length of the wire is shortened by 1 cm , the number of beats is still the same. The frequency of the fork is:
a) 404 Hz b) 400 Hz c) 396 Hz d) 384 Hz

191. A pipe 30 cm long, is open at both ends. Which harmonic mode of the pipe resonates a 1.1 kHz source? (Speed of sound in air = 330 m S^{-1})
a) First b) Second c) Third d) Fourth

192. Simple harmonic motion is the projection of uniform circular motion on
a) x-axis b) y-axis c) reference circle d) any diameter of reference circle

193. A simple pendulum executing SHM with a period of 6 s between two extreme positions Band e about a point O. If the length of the arc Be is 10 cm, how long will the pendulum take the move from position eto a position D towards 0 exactly midway between e and O?
a) 0.5s b) 1s c) 1.5s d) 3s

194. A wave has SHM (Simple Harmonic Motion) whose period is 4s while another wave which also possesses SHM has its period 3s. If both are combined, then the resultant wave will have the period equal to _____ .
a) 4 s b) 5 s c) 12 s d) 3 s

195. A source of sound of frequency 90 vibration/sec is approaching a stationary observer with a speed equal to 1/10 the speed of sound. What will be the frequency heard by the observer
a) 80 vibration/sec b) 90 vibration/sec c) 100 vibration/sec d) 120 vibration/sec

196. Water waves produced by a motor boat sailing in water are
a) neither longitudinal nor transverse b) both longitudinal and transverse
c) only longitudinal d) only transverse.

197. Motion of an oscillating liquid in a U tube is:
a) periodic but not simple harmonic. b) non-periodic.
c) simple harmonic and time period is independent of the density of the liquid.
d) simple harmonic and time period is directly proportional to the density of the liquid.

198. Two waves of wavelength 2 m and 2.02 m respectively, moving with the same velocity, superpose to produce 2 beats per second. The velocity of the waves is:
a) 400.0 m/s b) 404.0 m/s c) 402.0 m/s d) 406.0 m/s

199. Two tuning forks of frequencies 256 and 258 vibrations/sec are sounded together. Then, the time interval between two consecutive maxima heard by an observer is:
a) 2 sec b) 0.5 sec c) 250 sec d) 252 sec

200. Two particles execute SHM of same amplitude and same time period, about same mean position but with a phase difference between them. At an instant $x = +\frac{A}{3}$.The phase difference between them is

a) $2cos^{-1}\left(\frac{1}{5}\right)$ b) $2sin^{-1}\left(\frac{1}{5}\right)$ c) $2cos^{-1}\left(\frac{1}{3}\right)$ d) $2sin^{-1}\left(\frac{1}{5}\right)$

201. If V_m is the velocity of sound in moist air, V_d is the velocity of sound in dry air, under identical conditions of pressure and temperature:
a) $V_m > V_d$ b) V_m c) $V_m = V_d$ d) $V_m V_d = 1$

202. Which of the following statement is correct?
a)
A stationary wave appears to be stationary but transfer of energy from one particle to another continues to take place

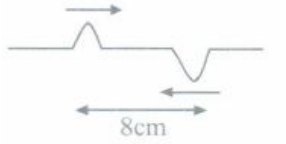
b)
If a transverse stationary wave of frequency n is formed in a medium, then frequency for variation of shear strain at a point will be equal to 2n

c)
Magnitude of strain is maximum at anti node because medium particles at antinodes have maximum possible
d) None of the above

203. A particle of mass m oscillates along x-axis according to equation $= a\sin\omega t$. The nature of the graph between momentum and displacement of the particle is:
a) Straight line passing through origin b) Circle c) Hyperbola d) Ellipse

204. For the wave $y = 20\sin 2\pi\left(\frac{x}{4} + \frac{t}{2}\right)$, the correct one is:(when xis in metre and t in sec)
a) amplitude is 20 m and frequency is 2 b) wavelength is 20 m and frequency is 1
c) frequency is 112 and wavelength is 20 cm d) $\omega = 2\pi$ and $k = \pi/2$

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



a) zero b) purely kinetic c) purely potential d) partly kinetic and partly potential

206. The stationary wave $y = 2a\sin kx\cos\omega t$, in a stretched string is the result of superposition of $y_1 = a\sin(kx - \omega t)$ and:
a) $y_2 = a\cos(kx + \omega t)$ b) $y_2 = a\sin(kx + \omega t)$ c) $y_2 = a\cos(kx - \omega t)$ d) $y_2 = a\sin(kx - \omega t)$

207. 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 :
a) 260 Hz b) 254 Hz c) 246 Hz d) 240 Hz

208. A particle executes linear simple harmonic motion with an amplitude of 3 cm. When the particle is at 2 cm from the mean position, the magnitude of its velocity is equal to that of its acceleration. Then its time period in seconds is:
a) $\sqrt{5}/2\pi$ b) $4\pi/\sqrt{5}$ c) $2\pi/\sqrt{5}$ d) $\sqrt{5}/\pi$

209. In a stationary wave there is:
a) neither energy current nor energy density
b) no energy current but there is energy density c) energy current but no energy density
d) both energy current and energy density

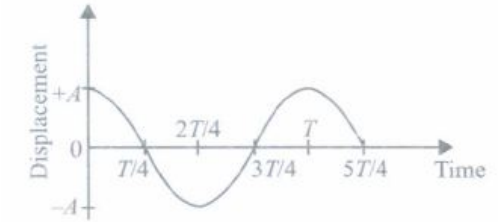
210. A wave of length 2 m is superposed on its reflected wave to form a stationary wave. A node is located at x = 3 m; the next node will be located at x equal to:

a) 3.25 m b) 3.50 m c) 3.75 m d) 4 m

211. The equation of a wave travelling in a string can be written as y = 3 cos π (100t - x), its wavelength is
a) 100 cm b) 2 cm c) 5 cm d) None of these

212. The equation of a wave is; $y = 5\sin\left(\frac{t}{0.04} - \frac{x}{4}\right)$, where x is in ern and t in seconds. The maximum velocity of the wave will be:
a) 1 ms^{-1} b) 2 ms^{-1} c) 1.5 ms^{-1} d) 1.25 ms^{-1}

213. The displacement -time graph for a particle executing SHM is as shown in figure.



Which of the following statements is correct?

a) The velocity of the particle is maximum at $t = \frac{3}{4}T$

b) The velocity of the particle is maximum at $t = \frac{T}{2}$

c) The acceleration of the particle is maximum at $t = \frac{T}{2}$

d) The acceleration of the particle is maximum at $t = \frac{3}{4}T$

214. A particle executes simple harmonic motion between x=-A and x=+A.The time taken for it to go from 0 A/2 is T_1 and to go from A/2 to A is T_2. Then
a) $T_1 < T_2$ b) $T_1 > T_2$ c) $T_I = T_2$ d) $T_1 = 2T_2$

215. A sound is produced by plucking a string in a musical instrument, then
a) the frequency of the wave in the string is equal to the frequency of the sound produced.
b) the wave in the string is progressive.
c) the tension in the string varies from point to point.
d) the velocity of wave in the string is equal to the velocity of sound in the string.

216. 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 sound emitted are 1 and f respectively. The apparent frequency and wavelength recorded by the observer are respectively.
a) 0.8f, 0.81 b) $1.2f, 1.21$ c) $1.2f, 1$ d) $f, 1.21$

217. The potential energy of a simple harmonic oscillator when the particle is half way to its end point is:
(where E is the total energy)
a) $\frac{1}{2}E$ b) $\frac{2}{3}E$ c) $\frac{1}{8}E$ d) $\frac{1}{4}E$

218. When a pulse or train of pulse travels along the length of the string (in X-direction), the elements of the string:
a) oscillate about their mean position as the pulse or wave passes through it
b) oscillate normal to the direction of wave motion along the string (i.e., along Y-direction)
c) oscillate along the direction of propagation of wave d) both (a) and (b)

219. A stone thrown into still water, creates a circular wave pattern moving radially outwards. If r is the distance measured from the centre of the pattern, the amplitude of the wave varies as:

a) $r^{-1/2}$ b) r^{-1} c) r^{-2} d) $r^{-3/2}$

220. The fundamental note produced by a closed organ pipe is of frequency u. The fundamental note produced by an open organ pipe of same length will be of frequency
a) $\frac{v}{2}$ b) v c) 2v d) 4v

221. A simple pendulum is made of a body which is a hollow sphere containing mercury suspended by means of a wire. If a little mercury is drained off, the period of pendulum will:
a) remain unchanged b) increase c) decrease d) become erratic

222. Assertion: The basic of Laplace correction was that, exchange of heat between the region of compression and rarefaction in air is not possible.
Reason: Air is a bad conductor of heat and velocity of sound in air is large.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

223. A transverse wave is travelling in a string. Equation of the wave:
a) is not equal to the shape of the string at an instant t
b) is general equation for displacement of a particle of the string
c) is an equation for displacement of the particle of one end only
d) must be sinusoidal equation

224. A man standing between two cliffs, claps his hands and starts hearing a series of echoes at intervals of one second. If speed of sound in air is 340 m/s, then distance between the cliffs is:
a) 340 m b) 680 m c) 1020 m d) 1360 m

225. A resonating air column shows resonance with a tuning fork of frequency 256 Hz at column lengths 33.4 cm and 101.8cm. The speed of sound in air is
a) 300 m S^{-1} b) 250 m S^{-1} c) 390 m S^{-1} d) 350 m S^{-1}

226. The time period of simple harmonic motion depends upon
a) amplitude b) energy c) phase constant d) mass

227. An organ pipe of cross-sectional area 100 cm? resonates with a tuning fork of frequency 1000 Hz in fundamental tone. The minimum volume of water to be drained so the pipe again resonates with the same tuning fork is (Take velocity of wave = 320 m S^{-1})
a) 800 cm^3 b) 1200 cm^3 c) 1600 cm^3 d) 2000 cm^3

228. A source of sound producing wavelength 50 cm is moving away from a stationary observer with $\left(\frac{1}{5}\right)^{th}$ speed of sound. Then what is the wavelength of sound received by the observer?
a) 55 cm b) 40 cm c) 60 cm d) 70 cm

229. Elevation of a cloud is 60° above the horizon. A thunder is heard 6 see after the lightning is observed. The speed of sound is 340 m s^{-1}. The vertical height of the cloud is:
a) 6 x 340 m b) 6 x 340 x cos 60^0m c) 6 x 340 x sin 60° m d) 6 x 340 x tan 60° m

230. A rocket is moving at a speed of 220 m S^{-1} towards a stationary target, emits a sound of frequency 1000 Hz. Some of the sound reaching the target gets reflected back to the rocket as an echo. The frequency of the echo as detected by the rocket is
(Take velocity of sound = 330 m S^{-1})
a) 3500 Hz b) 4000 Hz c) 5000 Hz d) 3000 Hz

231. The path difference between the two waves $y_1 = a_1 \sin(\omega t - 2\pi x/\lambda)$ and $y_2 = a_2 \cos(\omega t - 2\pi x/\lambda + \phi)$ is :
a) $\lambda/2\pi\phi$ b) $(\lambda/2\pi)(\phi+\pi/2)$ c) $(2\pi/\lambda)(\phi-\pi/2)$ d) $(2\pi/\lambda)(\phi)$

232. A wave travelling along positive x-axis is given by: $y = A\sin(\omega t - kx)$. If it is reflected from rigid boundary such that 80% amplitude is reflected, then equation of reflected wave is:
a) $y = A\sin(\omega t + kx)$ b) $y = -8.0A\sin(\omega t + kx)$ c) $y = 0.8A\sin(\omega t + kx)$ d) $y = A\sin(\omega t + 0.8kx)$

233. Which of the following is not a characteristics of simple harmonic motion?
a) The motion is periodic b) The motion is along a straight line about the mean position.
c) The oscillations are responsible for the energy conversion
d) The acceleration of the particle is directed towards the extreme position .

234. The equation of a plane progressive wave is: $y = 0.09\sin 8\pi\left(t - \frac{x}{20}\right)$. When it is reflected at rigid support, its amplitude becomes (2/3)rd of its previous value. The equation of the reflected wave is:
a) $y = 0.09\sin 8\pi\left(t - \frac{x}{20}\right)$ b) $y = 0.06\sin 8\pi\left(t - \frac{x}{20}\right)$ c) $y = 0.06\sin 8\pi\left(t + \frac{x}{20}\right)$
d) $y = -0.06\sin 8\pi\left(t + \frac{x}{20}\right)$

235. A transverse wave is passing through a medium. The maximum speed of the vibrating particle occurs when the displacement of the particle from the mean position is:
a) zero b) half of the amplitude c) equal to the amplitude d) none of these

236. The relation between frequency υ, wavelength λ and velocity of propagation of a wave v is
a) $\upsilon = \frac{\lambda}{v}$ b) $\upsilon = \lambda v$ c) $\upsilon = \frac{v}{\lambda}$ d) None of these

237. Two identical sounds S_1 and S_2 reach at a point P in phase. The resultant loudness at point P is n dB higher than the loudness of S_1, The value of n is:
a) 2 b) 4 c) 5 d) 6

238. Assertion: The speed of sound in solids is maximum though their density is large.
Reason: The coefficient of elasticity of solids is large.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

239. A simple harmonic wave train of amplitude 2 cm and time period 0:01 sec is travelling with a velocity of 10 m/sec in the positive X -direction. The displacement of the particle from the mean position, the particle velocity and particle acceleration at x = 150cm from the origin and at t = 3sec are:
a) 0,0,0 b) 0,400π cm/sec, 0 c) 0,0,400π cm/sec^2 d) 400π cm,0,0

240. The ratio of the velocity of sound in hydrogen $\left(\gamma = \frac{7}{5}\right)$ to that in helium $\left(\gamma = \frac{5}{3}\right)$ at the same temperature is
a) $\sqrt{\frac{5}{42}}$ b) $\sqrt{\frac{5}{21}}$ c) $\frac{\sqrt{42}}{5}$ d) $\frac{\sqrt{21}}{5}$

241. The speed of sound in a mixture of I mole of helium and 2 moles of oxygen at 27° C is:
a) 400 m/s b) 800 m/s c) 1200 m/s d) 600 m/s

242. Two waves are propagating along a taut string that coincides with the x-axis. The first wave has the wave function; $y_1 = A\cos[k(x - \upsilon t)]$ and the second has the wave function; $y_2 = A\cos[k(x + \upsilon t) + \phi]$:
a) for constructive interference at x= 0,$\phi = \pi$ b) for constructive interference at x= 0,$\phi = 3\pi$
c) for destructive interference at x= 0,$\phi = \pi$ d) for destructive interference at x = 0,$\phi = 2\pi$

243. The phase difference between displacement and acceleration of a particle in a simple harmonic motion is:

a) Zero b) π rad c) $\frac{3\pi}{2} rad$ d) $\frac{\pi}{2} rad$

244. Which of the following statements is correct?

a) The distance between any two consecutive antinodes or no nodes is $\frac{\lambda}{4}$.

b) The distance between a node and adjoining is c) In the open end is an node.

d) In the closed end is an antinode.

245. When a wave travels in a medium, the particle displacement is given by: $y = a\sin 2\pi(bt - cx)$, where a, b and e are constants. The maximum particle velocity will be twice the wave velocity if:

a) $c = \frac{1}{\pi a}$ b) $c = \pi a$ c) b = ac d) $b = \frac{1}{ac}$ e) a = bc

246. A train moving at a speed of 220 m/s towards a stationary object, emits a sound of frequency 1000 Hz. Some of the sound reaching the object gets reflected back to the train as echo. The frequency of the echo as detected by the driver of the train is (speed of sound in air is 330 m/s) :

a) 4000 Hz b) 5000 Hz c) 3000 Hz d) 3500 Hz

247. A simple harmonic oscillator has an amplitude a and time period T. The time required by it to travel from $x = a$ to $x = \frac{a}{2}$ is _____ .

a) $\frac{T}{6}$ b) $\frac{T}{4}$ c) $\frac{T}{3}$ d) $\frac{T}{2}$

248. A sine wave has an amplitude A and wavelength λ. The ratio of particle velocity and the wave velocity is:$(2\pi A = \lambda)$

a) ≤ 1 b) =1 c) ≥ 1 d) none of these

249. At resonance, the amplitude of forced oscillations is

a) minimum b) maximum c) zero d) none of these

250. In stationary wave, node is the point having:

a) maximum density b) maximum displacement c) minimum density d) maximum strain

251. Two sound waves having a phase difference of 60° have a path difference of:

a) 2λ b) $\lambda/2$ c) $\lambda/6$ d) $\lambda/3$

252. Define Mach Number.

a) It is the ratio of the stress to strain b) It is the ratio of the strain to stress

c) It is the ratio of the velocity of an object to the velocity of sound

d) It is the ratio of the velocity of sound to the velocity of an object

253. Two waves: $y = 0.25\sin 316t,\ y = 0.25\sin 310t$ are travelling in same direction. The number of beats produced per second will be:

a) 6 b) 3 c) $3/\pi$ d) 3π

254. Which one of the following statements is true for the speed v and the acceleration a of a particle executing simple harmonic motion?

a) When v is maximum. a is zero b) When vis maximum, a is maximum

c) Value of a is zero, whatever may be the value of v d) When v is zero. a is zero

255. An ideal gas enclosed in a vertical cylindrical container supports a freely moving piston of mass M. The piston and the cylinder have equal cross sectional area A. When the piston is in equilibrium, the volume of the gas is Va and its pressure is P_o' The piston is slightly displaced from the equilibrium position and released. Assuming that the system is completely isolated from its surrounding, the piston executes a simple harmonic motion with frequency

a) $\frac{1}{2\pi}\sqrt{\frac{MV_0}{A\lambda P_0}}$ b) $\frac{1}{2\pi}\frac{A\gamma P_0}{V_0 M}$ c) $\frac{1}{2\pi}\frac{V_0 M P_0}{A^2\gamma}$ d) $\frac{1}{2\pi}\sqrt{\frac{A^2\gamma P_0}{MV_0}}$

256. The length of a seconds pendulum on the surface of earth is 1m. Its length on the surface of the moon is

a) $\frac{1}{6}m$ b) 1m c) $\frac{1}{36}m$ d) 36 m

257. Natural length of the spring is 40 cm and its spring constant is 4000 N m^{-1}. A mass of 20 kg is hung from it. The extension produced in the spring is (Giveng= 9.8 ms^{-2})

a) 4.9 cm b) 0.49 cm c) 9.4 cm d) 0.94 cm

258. A rectangular block of mass 111 and area of crosssection A floats in a liquid of density p. If it is given a small vertical displacement from equilibrium it undergoes oscillation with a time period T. Then

a) $T \propto \frac{1}{\sqrt{m}}$ b) $T \propto \sqrt{\rho}$ c) $T \propto \frac{1}{\sqrt{A}}$ d) $T \propto \frac{1}{\rho}$

259. The circular motion of a particle with constant speed is

a) periodic and simple harmonic. b) simple harmonic but not periodic.

c) neither periodic nor simple harmonic d) periodic but not simple harmonic.

260. Two sound waves of equal intensity I produce beats. The maximum intensity of sound produced in beats will be:

a) I b) 4 I c) 2 I d) $\frac{I}{2}$

261. The displacement of a particle along the x-axis is given by x = a sin2 ωt. The motion of the particle corresponds to:

a) Simple harmonic motion of frequency ω/p

b) Simple harmonic motion of frequency 3ω/2π c) Non-simple harmonic motion

d) Simple harmonic motion of frequency ω/2π

262. Which of the following statements is incorrect during propagation of a plane progressive mechanical wave?

a) All the particles are vibrating in the same phase. b) Amplitude of all the particles is equal

c) Particles of the medium executes SHM

d) Wave velocity depends upon the nature of the medium.

263. A travelling wave represented by y (x, t) = asin(kx - ωt) is superimposed on another wave represented by y(x, t) = asin(kx + ωt). The resultant is:

a) standing wave having nodes at x =$x = \left(n + \frac{1}{2}\right)\frac{\lambda}{2}$; n - 0,1,2, ...

b) standing wave having nodes at x =$\frac{n\lambda}{2}$n= 0,1,2, ... c) wave travelling along + x direction.

d) wave travelling along - x direction.

264. A thin plane membrane separates hydrogen at 7° C from hydrogen at 47° C, both being at the same pressure. If a collimated sound beam travelling from the cooler gas makes an angle of incidence of 30° at the membrane, the angle of refraction is:

a) $\sin^{-1}\sqrt{\frac{7}{32}}$ b) $\sin^{-1}\sqrt{\frac{2}{7}}$ c) $\sin^{-1}\sqrt{\frac{4}{7}}$ d) $\sin^{-1}\sqrt{\frac{7}{4}}$

265. A tuning fork is set into vibrations and then it is held with its stem resting on a table. How will duration of its vibrations be affected?

a) It will vibrate for same duration b) It will vibrate for a longer duration

c) It will vibrate for a shorter duration

d) The duration will increase or decrease depending upon the dimensions of the table

266. A second harmonic has to be generated in a string of length L stretched between two rigid supports. The point where the string has to be plucked and touched are

a) plucked at $\frac{L}{4}$ and touch at $\frac{L}{2}$ b) plucked at $\frac{L}{4}$ and touch at c) plucked at $\frac{L}{2}$ and touch at $\frac{L}{2}$
d) plucked at $\frac{L}{2}$ and touch at $\frac{3L}{4}$

267. Change in temperature of the medium changes
a) frequency of sound waves b) amplitude of sound waves
c) wavelength of sound waves. d) loudness of sound waves

268. Which of the following waves is used in sonography?
a) Radio waves b) X-rays c) Ultrasonic waves d) Gamma rays

269. Which of the following properties of a wave is independent of others?
a) Velocity b) Frequency c) Amplitude d) Wavelength

270. Two sine waves travel in the same direction in a medium. The amplitude of each waves is A and phase difference between the two waves is 120°. The resultant amplitude will be:
a) A b) 2A c) 4A d) $\sqrt{2}A$

271. In the following question, a statement of assertion is followed by a statement of reason. Mark the correct choice as :
Assertion: A block of small mass m attached to a stiff spring will have large oscillation frequency
Reason : Stiff springs have high value of spring constant.
a) If both assertion and reason are true and reason is the correct explanation of assertion
b) If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false d) If both assertion and reason are false

272. It takes 2.0 seconds for a sound wave to travel between two fixed points when the day temperature is 10^0C. If the temperature rises to 30° C the sound wave travels between the same fixed points in:
a) 1.9 sec b) 2.0 sec c) 2.1 sec d) 2.2 sec

273. The potential energy of a long spring when stretched by 2 cm is U. If the spring is stretched by 8 cm. the potential energy stored in it is:
a) 8 U b) 16 U c) U/4 d) 4 U

274. Two vibrating tuning forks produce progressive waves given by:
$y_1 = 4\sin(500\pi t)$ and $y_2 = 2\sin(506\pi t)$, They are held near the ear of a person. If the number of beats heard per second be B and the ratio of maximum to minimum intensity be A, then:
a) B =3 and A =2 b) B =3 and A =9 c) B = 6 and A = 2 d) B = 6 and A = 9

275. A sound wave of frequency 500 Hz covers a distance of 1000 m in 5 second between points X and Y. The number of waves between X and Y are:
a) 500 b) 1000 c) 2500 d) 5000

276. Two SHMs with same amplitude and time period when acting together in perpendicular directions with a phase difference of ππ/2 give rise to:
a) elliptical motion b) circular motion c) straight motion d) none of these

277. The equation of a wave moving on a string is $y = 8\sin 2\pi(0.01x - 2.00t)$, where y and x are in ems and t in second. The amplitude of the wave is:
a) 200 cm b) 100 cm c) 50 cm d) 8 cm

278. The equation for a wave propagating with a velocity of 330 m/s and having a frequency of 110Hz and amplitude 0.05 m is:
a) $y = 0.05\sin 2\pi\left[100t + \frac{x}{3}\right]$ b) $y = 0.05\sin 2\pi\left[100t - \frac{x}{3}\right]$ c) $y = 0.05\sin 2\pi\left[100t \pm \frac{x}{3}\right]$
d) $y = 0.05\sin[100t - 330x]$

279. A body of mass m is attached to the lower end of a spring whose upper end is fixed. The spring has negligible mass. When the mass m is slightly pulled down and released, it oscillates with a time period of 3 s. When the mass m is increased by 1 kg, the time period of oscillations

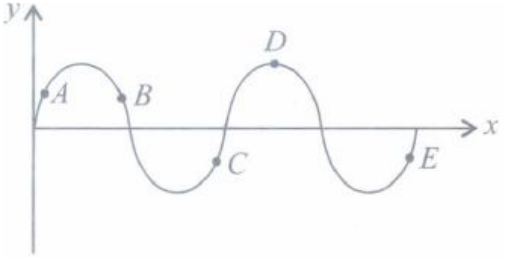
becomes 5s. The value of m in kg is

a) 3/4 b) 4/3 c) 16/9 d) 9/16

280. Two waves are approaching each other with a velocity of 20 m/s and frequency n. The dist nodes is _____ .

a) $\frac{20}{n}$ b) $\frac{10}{n}$ c) $\frac{5}{n}$ d) $\frac{n}{10}$

281. Figure shows a sinusoidal wave at a given instant.



Which points are in phase?

a) A, B b) B, C c) B, D d) C, E

282. Phase difference between two particles of a medium lying between two consecutive nodes is:

a) zero b) π/4 c) π/2 d) π

283. 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:

a) 555.5 Hz b) 720 Hz c) 500 Hz d) 550 Hz

284. A sound wave travelling with a velocity v in a medium A reaches a point on the interface of medium A and medium B. If the velocity in the medium B be $2v$, the angle of incidence for total internal reflection of the wave will be:

a) >15° b) >30° c) >45° d) >90°

285. A sound wave is passing through air column in the form of compressions and rarefactions. In consecutive compressions and rarefactions:

a) density of the air in a region changes

b) velocity of the particles of air is perpendicular to wave velocity c) density is constant

d) none of the above

286. A particle is executing SHM with amplitude A and has maximum velocity V_o. Its speed at displacement A/2 wili be:

a) $\left(\sqrt{3}\right)V_0/2$ b) $V_0/2$ c) V_o d) $V_o/4$

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

a) 21 b) 43 c) 86 d) 129

288. A simple pendulum suspended from the roof of a lift oscillates with frequency u when the lift is at rest. If the lift falls freely under gravity, its frequency of oscillation becomes

a) zero b) v c) $2v$ d) infinite

289. To demonstrate the phenomenon of beats, we need:

a) two sources which emit radiation of nearly the same frequency

b) two sources which emit radiation of exactly the same frequency

c)

two sources which emit radiation of exactly the same frequency and have a definite phase relationship

d) two sources which emit radiation of exactly the same wavelength

290. Which of the following x- t graphs does not represent periodic motion?

a)  b) 

c)  d) 

291. A train approaching a railway platform with a speed of 20 m S^{-1} starts blowing the whistle. Speed of sound in air is 340 m S^{-1}. If the frequency of the emitted sound from the whistle is 640 Hz, the frequency of sound as heard by person standing on the platform is
a) 600 Hz b) 640 Hz c) 680 Hz d) 720 Hz

292. The equation of a wave is: $x = 5\sin\left(\frac{t}{0.04} - \frac{x}{4}\right)cm.$ Find the maximum velocity of the particles of the medium:
a) 1 m/s b) 1.5 m/s c) 1.25 m/s d) 2 m/s

293. A vibrating tuning fork generates a wave given by: $y = 0.1\ \sin\pi(0.1x - 2t),$ where x and y are in metre and t in second. The distance travelled by the wave while the fork completes 30 vibrations is:
a) 600 m b) 20 m c) 30 m d) 200 m

294. A steel rod 100 cm long is clamped at its mid-point. The fundamental frequency of longitudinal vibrations of the rod is given to be 2.53 kHz. What is the speed of sound in steel?
a) 5.06 km/s b) 6.06 km/s c) 7.06 km/s d) 8.06 km/s

295. Each of the two strings of length 51.6 cm and 49.1 cm are tensioned separately by 20 N force. Mass per unit length of both the strings is same and equal to 1 g/m. When both the strings vibrate simultaneously the number of beats is:
a) 7 b) 8 c) 3 d) 5

296. Two sinusoidal plane waves of the same frequency having intensities I_0 and $4I_0$ are travelling in the same direction. The resultant intensity at a point at which waves meet with a phase difference of zero radian is:
a) I_0 b) $5I_0$ c) $9I_0$ d) $3I_0$

297. The equation for the displacement of a stretched string is given by: $y = 4\sin 2\left(\frac{t}{0.02} - \frac{x}{100}\right).$
Where, y and x are in em and t in Sec. The (i) frequency (ii) velocity of the wave (iii) maximum particle velocity are:
a) 50 Hz, 50 m/s, 20π m/s b) 50 Hz, 20 m/s, 50 m/s c) 50 Hz, 50 m/s, 20π m/s
d) 50 Hz, 50 m/s, 4π m/s

298. In a guitar, two strings A and B made of same materiat are slightly out the 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:
a) 537 Hz b) 523 Hz c) 524 Hz d) 536 Hz

299. 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 superposed on each other. The resulting amplitude and phase are respectively:
a) $\sqrt{45} and \quad \tan^{-1}(1/2)$ b) $\sqrt{45} and \quad \tan^{-1}(1/3)$ c) $\sqrt{75} and \quad \tan^{-1}(1/2)$ d) $\sqrt{75} and \quad \tan^{-1}(1/3)$

300. A particle is executing SHM along a straight line. Its velocities at.distances x_1 and x_2 from the mean position are V_1 and V_2, respectively. Its time period is:

a) $2\pi\sqrt{(x_1^2+x_2^2)/(V_1^2+V_2^2)}$ b) $2\pi\sqrt{(x_2^2-x_1^2)/(V_1^2+V_2^2)}$ c) $2\pi\sqrt{(x_2^2-x_1^2)/(V_1^2-V_2^2)}$
d) $2\pi\sqrt{(V_1^2+V_2^2)/(x_1^2-x_2^2)}$

301. A small piece of cork in a ripple tank oscillates up and down as ripples pass it. If the ripples travelling at 0.3 m/s have a wavelength of 1.5π cm and the cork vibrates with an amplitude of 5 mm, the maximum velocity of the cork is:
a) 20 cm/sec b) 20 m/sec c) 0.02 m/sec d) 200 cm/sec

302. A tuning fork A produces 4 beats per second with another tuning fork B of frequency 320 Hz. On filing one of the prongs of A, 4 beats per second are again heard when sounded with the same fork B. Then, the frequency of the fork A before filing is:
a) 328 Hz b) 316 Hz c) 324 Hz d) 320 Hz

303. The equation of a simple harmonic wave is given by Y = 5 sin $\frac{\pi}{2}$ (l00 t - x), where x and yare in metre and time is in second. The time period of the wave (in seconds) will be
a) 0.04 b) 0.01 c) 1 d) 5

304. The efficiency of an ideal heat engine working between the freezing point and boiling point of water, is
a) 6.25% b) 20% c) 26.8% d) 12.5%

305. A pipe 17 cm long is closed at one end. Which harmonic mode of the pipe resonates a 1.5 kHz source? (Speed of sound in air = 340 m S^{-1})
a) First b) Third c) Fifth d) Seventh

306. P and Q are two wires whose fundamental frequencies are 256 Hz and 382 Hz respectively. How many beats in two seconds will be heard by the third harmonic of A and second harmonic of B?
a) 4 b) 8 c) 16 d) zero

307. A linear harmonic oscillator of force constant 2 x 10^6 N/m and amplitude 0.01 m has a total mechanical energy of 160J. Its _____ .
a) maximum potential energy is 160 J b) maximum potential energy is 100 J
c) maximum potential energy is zero d) minimum potential energy is 100 J

308. Decibel is the unit of:
a) intensity of light b) X-ray radiation capacity c) sound loudness d) energy of radiation

309. A stretched string of length l, fixed at both ends can sustain stationary waves of wavelength λ given by
a) $\lambda=n^2/2l$ b) $\lambda=l^2/2n$ c) $\lambda=2l/n$ d) $\lambda=2ln$