Ravi Maths Tuition Centre

Time : 1 Mins **OSCILLATIONS' AND WAVES 1 1** **Marks : 1453**

1. The displacement of an elastic wave is given by the function y = 3sinωt + 4 cosωt, where y is in cm and t is in s. The resultant amplitude is:
   a) 3 cm b) 4 cm c) 5 cm d) 7 cm
2. The picture of a progressive transverse wave at a particular instant of time gives:
   a) shape of the wave b) motion of the particles of the medium c) velocity of the wave
   d) none of the above
3. A wave is represented by the equation: $y = 7\sin\left(7\pi t - 0.04x + \frac{\pi}{3}\right)$. Where, x is in metres and t in seconds. The speed of the waves is:
   a) (175π)m/s b) (49π)m/s c) (49/π)m/s d) (0.28π)m/s
4. To demonstrate the phenomenon of interference, 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
5. A standing wave having 3 node and 2 antinodes is formed between two atoms having a distance 1.21 A^o between them. The wavelength of the standing wave is _____ .
   a) 1.21 A^o b) 1.42 A^o c) 6.05 A^o d) 3.63 A^o
6. Assertion: Variation in air pressure do not affect the speed of sound when temperature remains constant.
   Reason: Speed of sound is directly proportional to square root of pressure.
   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.
7. Through binoculars a man watches a carpenter driving nails at a regular rate of 1 stroke per second. He hears the sound of the blow exactly synchronized with the blows he sees.
   He hears two more blows after he sees the carpenter stops hammering. The distance of the carpenter is: (c = 340m/s)
   a) 340 m b) 680 m c) 510 m d) 170 m

8. A guitar string is 90 cm long and has a fundamental frequency of 124 Hz. To produce a fundamental frequency of 186 Hz, the guitar should be pressed
   a) 60 cm b) 30 cm c) 20 cm d) 10 cm
9. Two sources of intensity I and 4I are used in an interference experiment. The intensity at points where the waves from the two sources superpose with a phase difference(i) zero (ii) $\pi/2$ and (iii) π , are:
   a) $5I, 3I, 0$ b) $5I, 3I, 2I$ c) $9I, 5I, I$ d) $9I, 5I, 0$
10. The general equation of a wave in a string is: $y = 0.1\sin\pi(0.10x - 8t + 1.3)$. The equation of the wave that would produce a stationary wave with the given wave is:
    a) $y = 0.1\cos\pi(0.10x - 8t + 1.3)$ b) $y = 0.1\sin\pi(0.10x + 8t + 1.3)$ c) $y = 0.1\sin\pi(8x + 0.10t + 1.3)$
    d) $y = 0.1\cos\pi(8x + 0.10t + 1.3)$
11. Out of the following gases under similar condition of temperature and pressure, the velocity of sound will be maximum in
    a) hydrogen b) nitrogen c) oxygen d) chlorine
12. Two pendulums differ in lengths by 22 cm. They oscillate at the same place so that one of them makes 30 oscillations and the other makes 36 oscillations during the same time. The lengths (in crn) of the pendulums are
    a) 72 and 50 b) 60 and 38 c) 50 and 28 d) 80 and 58
13. A spring is loaded with two blocks m_1 and m_2, where m_1 is rigidly fixed with the spring and m_1 is Just kept on the block m_1. The maximum energy of oscillation is possible for the system having the block m_2 in contact with m_1 is.
    a) $\frac{m_1^2 g^2}{k}$ b) $\frac{m_1 g^2}{2k}$ c) $\frac{m_2^2 g^2}{2k}$ d) $\frac{(m_1 + m_2)^2 g^2}{2k}$
14. The distance between two points differing in phase by 60° on a wave having a wave velocity 360 m/s and frequency 500 Hz is:
    a) 0.72 metre b) 0.18 metre c) 0.12 metre d) 0.36 metre
15. A string of length L is stretched by L/20 and the speed of transverse waves along it is v. The speed of wave when it is stretched by L/10 will be: (assume that Hooke's law is applicable)
    a) $2v$ b) $v/\sqrt{2}$ c) $\sqrt{2}v$ d) $2v$
16. The speed of sound waves in a gas:
    a) does not depend upon density of the gas b) does not depend upon changes in pressure
    c) does not depend upon temperature d) depends upon density of the gas
17. If sound waves can be assumed to be diffracted which of the following objects will diffract sound waves in air from a 384 Hz tuning fork?
    a) A sphere of radius 10 m b) A sphere of radius 1 m c) A sphere of radius 1 mm
    d) A sphere of radius 1 cm
18. A particle executing simple harmonic motion with an amplitude A. The distance travelled by the particle in one time period is
    a) zero b) A c) 2A d) 4A
19. A standing wave is represented by y = a sin (100 t) cos (0.01)x, where y and a are in millimetre, t in second and x is in metre. Velocity of wave is _____ .

a) 10^4 m/s b) 1 m/s c) 10^{-4} m/s d) None of these

20. There are three sources of sound of equal intensity with frequencies 400, 401 and 402 vibrations/sec. The number of beats heard per second is:
    a) 0 b) 1 c) 2 d) 3

21. Two points are located at a distance of 10 m and 15 m from the source of oscillation. The period of oscillation is 0.05 sec and the velocity of the wave is 300 m/sec, What is the phase difference between the oscillations of two points?
    a) π/6 b) π/3 c) 2π/3 d) π

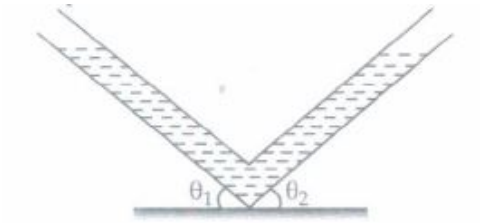
22. Which of the following motions is not simple harmonic?
    a) Vertical oscillations of a spring b) Motion of a simple pendulum
    c) Motion of planet around the sun d) Oscillation of liquid in aU-tube

23. 56 tuning forks are so arranged in series that each fork gives 4 beats per see with the previous one. The frequency of the last fork is 3 times that of the first. The frequency of the first fork is:
    a) 110 b) 56 c) 60 d) 52

24. The equation of a sound wave is y = 0.0015 sin (62.4x+ 316t).Find the wavelength of this wave:
    a) 0.2 unit b) 0.1 unit c) 0.3 unit d) cannot be calculated

25. At what temperature the velocity of sound in a gas is thrice of its velocity at 0° C?
    a) 2184°C b) 2457°C c) 2184 K d) 819 K

26. A non viscous liquid of density p is filled in a tube with A as the area of cross section, as shown in the figure. If the liquid is slightly depressed in one of the arms, the liquid column oscillates with a frequency



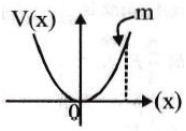
a) $\frac{1}{2\pi}\sqrt{\frac{\rho g A \sin\left(\frac{\theta_1+\theta_2}{2}\right)}{m}}$ b) $\frac{1}{2\pi}\sqrt{\frac{\rho g A\left(\sin\theta_1-\sin\theta_2\right)}{m}}$ c) $\frac{1}{2\pi}\sqrt{\frac{\rho g A\left(\sin\theta_1+\sin\theta_2\right)}{m}}$ d) $\frac{1}{2\pi}\sqrt{\frac{\rho g A\left(\frac{\theta_1-\theta_2}{2}\right)}{m}}$

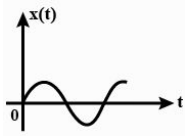
27. One end of a taut string of length 3 m along the x-axis is fixed at x = O. The speed of the waves in the string is 100 m s^{-1}. The other end of the string is vibrating in the y direction so that stationary waves are set up in the string. The possible waveform(s) of these stationary waves is (are).

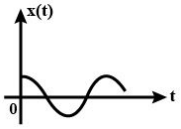
a) $y(t) = A\sin\frac{2\pi x}{6}\cos\frac{50\pi t}{3}$ b) $y(t) = A\sin\frac{\pi x}{3}\cos\frac{100\pi t}{3}$ c) $y(t) = A\sin\frac{5\pi x}{6}\cos\frac{255\pi t}{3}$ d) $y(t) = A\sin\frac{5\pi x}{2}\cos 250\pi t$

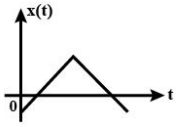
28. The total energy of a particle executing simple harmonic motion is proportional to:
    a) displacement from equilibrium position b) frequency of oscillation
    c) velocity of equilibrium position d) square of amplitude of motion

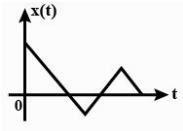
29. A particle of mass m is released from rest and follows a parabolic path as shown. Assuming that the displacement of the mass from the origin is small, which graph correctly depicts the position of the particle as a function of time.



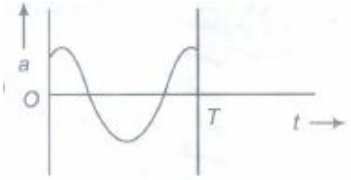
a) 

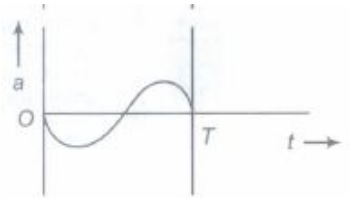
b) 

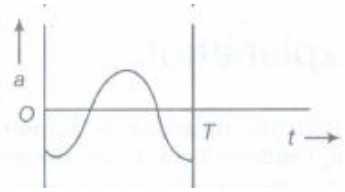
c) 

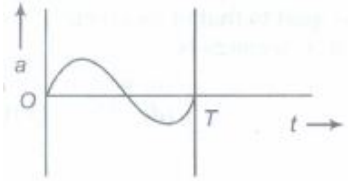
d) 

30. The oscillation of a body on a smooth horizontal surface is represented by the equation X = A cos (ωt), where X = displacement at time t, ω = frequency of oscillation. Which one of the following graph shows correctly variation of 'a' with 't?

a) 

b) 

c) 

d) 

31. Two waves are represented by: $y_1 = a\sin\left(\omega t + \frac{\pi}{6}\right)$ and $y_2 = a\cos\omega t$. What will be their resultant amplitude?
    a) a b) $\sqrt{2}a$ c) $\sqrt{3}a$ d) 2a

32. The wave described by y = 0.25 sin(10 πx - 2πt), where x and y are in meters and t in seconds, is a wave travelling along the:
    a) -ve x direction with amplitude 0.25 m and wavelength λ= 0.2 m
    b) -ve x direction with frequency 1 Hz
    c) +ve x direction with frequency Hz and wavelength λ= 0.2 m
    d) +ve x direction with frequency 1 Hz and wavelength λ= 0.2 m

33. When a tuning fork vibrates, the waves produced in the fork are:
    a) longitudinal b) transverse c) progressive d) stationary

34. When two tuning forks (fork 1 and fork 2) are sounded simultaneously, 4 beats per second are heard. Now, some tape is attached on the prong of fork 2. When the tuning forks are sounded again, 6 beats per second are heard. If the frequency of fork 1 is 200 Hz, then what was the original frequency of fork 2?
    a) 196 Hz b) 204 Hz c) 200 Hz d) 202 Hz

35. Two sitar strings A and B are slightly out of tune and produce beats of frequency 5 Hz. When the tension in the string B is slightly increased, the beat frequency is found to reduce to 3 Hz. If the frequency of string A is 427 Hz, the original frequency of string B is
    a) 422 Hz b) 424 Hz c) 430 Hz d) 432 Hz

36. A person hears the sound of a jet aeroplane after it has passed over his head. The angle of the jet plane with the horizontal when the sound appears to be coming vertically downwards is 60°, If the velocity of sound is v, then the velocity of the jet plane should be:
    a) $2v$ b) $v/\sqrt{3}$ c) $\sqrt{3}v$ d) v
37. A point source emits sound equally in all directions in a non-absorbing medium. Two points P and Q are at a distance of 9 m and 25 m respectively from the source. The ratio of the amplitude of waves at P and Q is:
    a) $\frac{3}{5}$ b) $\frac{5}{3}$ c) $\frac{9}{25}$ d) $\frac{25}{9}$
38. Standing waves are produced in a 10 m long stretched string. If the string vibrates in 5 segments and the wave velocity is 20 m/s, the frequency is _____ .
    a) 10 Hz b) 5 Hz c) 4 Hz d) 2 Hz
39. With the propagation of a longitudinal wave through a material medium, the quantities transmitted in the direction of propagation are:
    a) energy, momentum and mass b) energy c) energy and mass
    d) energy and linear momentum
40. The power of sound from the speaker of a radio is 20 mW. By turning the knob of volume control the power of sound is increased to 400 mW. What is the power increase as compared to the original power?
    a) 1.3 dB b) 3.1 dB c) 13 dB d) 30.1 dB
41. Pick out the wrong statement.
    a) Transvene waves can be generated in solids.
    b) A system having ice floating on water has the same volume even after the i. e is melted.
    c) Heat radiations have the velocity of light.
    d) Phase will not change when sound or light waves art reflected back
42. A particle is subjected to two mutually perpendicular simple harmonic motions such that its x and Y coordinates are given by $x = 2\sin\omega t$ and $y = 2\sin\left(\omega t + \frac{\pi}{4}\right)$. The path of the particle will be:
    a) an ellipse b) a straight line c) a parabola d) a circle
43. Two sources P and Q produce notes of frequency 660 Hz each. A listener moves from P to Q with a speed of 1 ms^{-1}. If the speed of sound is 330 rn/s, then the number of beats heard by the listener per second will be:
    a) zero b) 4 c) 8 d) 2
44. Beats are produced by two progressive waves. Maximum loudness at the waxing is x times the loudness of each wave. The value of x is:
    a) 1 b) $\sqrt{2}$ c) 2 d) 4
45. Which of the following equations represents a wave travelling along y-axis?
    a) $y = A\sin(kx - \omega t)$ b) $y = A\sin(ky - \omega t)$ c) $y = A\sin\ ky\cos\omega t$ d) $y = A\cos ky\sin\omega t$
46. Two coherent sources must have the same:
    a) amplitude b) phase difference only c) frequency only d) both (b) and (c)

47. Two identical straight wires are stretched so as to produce 6 beats per second when vibrating simultaneously. On changing the tension slightly in one of them, the beat frequency still remains unchanged. Denoting by T_1, T_2 the higher and the lower initial tensions in the string, it could be said that while making the above changes in tension:
    a) T_1 was decreased b) T_1 was increased c) T_2 was increased d) T_2 was decreased

48. 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) increased by a factor of 2 b) decreased by a factor of 2 c) decreased by a factor of 4
    d) unchanged

49. One of the modes of resonance in a tube containing water at one end has been shown. The tube in the present case is in

    a) first harmonic b) third harmonic c) fifth harmonic d) seventh harmonic

50. A star which is emitting radiation at a wavelength of 5000 A^o is approaching the earth with a velocity of 1.50×10^6 m/s. The change in wavelength of the radiation as received on the earth is _____ .
    a) 0.25 A^o b) 2.5 A^o c) 25 A^o d) 250 A^o

51. peed ot sound wave in air
    a) is independent of temperature b) increases with pressure
    c) increases with increase in humidity d) decreases with increase in humidity.

52. A point source emits sound equally in all directions in a non-absorbing medium. Two points P and Q are at distances of 2m and 3m respectively from the source. The ratio of the intensities of the waves at P and Q is _____ .
    a) 3: 2 b) 2: 3 c) 9: 4 d) 4: 9

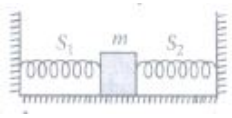
53. The equation of a simple harmonic wave is given by y = 3 sin π/2 (50t - x) where x and y are in meters and t is in seconds. The ratio of maximum particle velocity to the wave velocity is :
    a) 3π/2 b) 3π c) 2π/3 d) 2π

54. Two simple harmonic motions are represented by the equations:

    $Y_1 = 10\sin\left(3\pi t + \frac{\pi}{4}\right)$ and $Y_2 = 5(\sin 3\pi t + \sqrt{3}\cos 3\pi t)$. Their amplitudes are in the ratio of:

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

55. 1When a mass m is connected ~ individually to two springs S_1 m S_2 S_1 and S_2' the oscillation . frequencies are υ_1 and υ_2. If the same mass is attached to the two springs as shown in figure, the oscillation frequency would be



a) $v_1 + v_2$ b) $\sqrt{v_1^2 + v_2^2}$ c) $\left(\frac{1}{v_1} + \frac{1}{v_2}\right)^{-1}$ d) $\sqrt{v_1^2 - v_2^2}$

56. In the following question, a statement of assertion is followed by a statement of reason. Mark the correct choice as :
Assertion: The motion of a simple pendulum is simple harmonic for all angular displacement.
Reason: Motion of simple pendulum is independent of the angular 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

57. A bat emits ultrasonic sound of frequency 100 kHz in air. If this sound meets a water surface, the wavelengths of the reflected and transmitted sound are (Speed of sound in air = 340 m S^{-1} and in water = 1500 m S^{-1})
a) 3.4 mm, 30 mm b) 6.8 mm, 15 mm c) 3.4 mm, 15 mm d) 6.8 mm, 30 mm

58. The velocity of sound waves in an ideal gas at temperatures T_1(K) and T_2 (K) are respectively v_1 and v_2. The rms velocities of gas molecules at these two temperatures are W_1 and W_2 respectively; then:
a) $\frac{v_1}{v_2} = \frac{w_1}{w_2}$ b) $\frac{v_1}{v_2} = \sqrt{\gamma}\left(\frac{w_1}{w_2}\right)$ c) $\frac{v_1}{v_2} = \sqrt{\frac{\gamma}{3}}\left(\frac{w_1}{w_2}\right)$ d) $\frac{v_1}{v_2} = \sqrt{\frac{w_1}{w_2}}$

59. The bob of a simple pendulum of mass m and total energy E will have maximum linear momentum equal to:
a) $\sqrt{2E/m}$ b) $\sqrt{2mE}$ c) 2mE d) mE^2

60. A particle executing simple harmonic motion of amplitude 5 cm has maximum speed of 31.4 cm/s. The frequency of its oscillation is:
a) 1 Hz b) 3 Hz c) 2 Hz d) 4 Hz

61. A 5.5 m length of string has a mass of 0.035 kg. If the tension in the string is 77 N, the speed of a wave on the string is _____ .
a) 110 ms^{-1} b) 165 ms^{-1} c) 77 ms^{-1} d) 102 ms^{-1}

62. Two vibrating tuning forks produce progressive waves given by $Y_1 = 4 \sin 500\ pt$ and $Y_2 = 2 \sin 506\ pt$. Number of beats produced per minute is _____ .
a) 360 b) 180 c) 60 d) 3

63. Two simple pendulums of length 0.5 m and 2.0 m respectively are given small linear displacement in one direction at the same time. They will again be in the same phase when the pendulum of shorter length has completed oscillations.
a) 5 b) 1 c) 2 d) 3

64. A stone is dropped into a lake from a tower of 500 m height. The sound of the splash will be heard by the man after:
a) 21 sec b) 10 sec c) 11.5 sec d) 14 sec

65. The equation of motion of a simple harmonic motion is

a) $\frac{d^2x}{dt^2} = -\omega^2 x$ b) $\frac{d^2x}{dt^2} = -\omega^2 t$ c) $\frac{d^2x}{dt^2} = -\omega x$ d) $\frac{d^2x}{dt^2} = -\omega t$

66. Tuning fork A of frequency 258 cycles/see gives 8 beats with a tuning fork B. When prongs of B are cut and again A and B are sounded the number of beats heard remains same. The frequency of B (in cycles/sec) is:

a) 250 b) 264 c) 242 d) 258

67. The equation of a wave is represented by $y = 10^{-4}\sin\left(100t - \frac{x}{10}\right)m,$ the velocity of wave will be:

a) 100 m/s b) 4 m/s c) 1000 m/s d) zero

68. The equation of a plane progressive wave is given by: y = 0.025 sin (100 t + 0.25x) . The frequency of this wave would be:

a) $(50/\pi)Hz$ b) 100 Hz c) $(100/\pi)Hz$ d) 50 Hz

69. The speed of sound in oxygen (0_2)at a certain temperature is 460 ms $^{-1}$. The speed of sound in helium (He) at the same temperature will be: (assume both gases to be ideal)

a) 1420 ms^{-1} b) 500 ms^{-1} c) 650 ms^{-1} d) 330 ms^{-1}

70. A man is watching two trains, one leaving and the other coming in with equal speed of 4 m/s. If they sound their whistles, each of frequency 240 Hz, the number of beats heard by the man (velocity of sound in air = 320 m/s) will be equal to :

a) 6 b) 3 c) 0 d) 12

71. Which of the following statements are true for the function used to describe the travelling wave?

a) Such a function at every instant should give the shape of the wave at that instant

b)

At very given location, it should describe the motion of the constituents of the medium at that instant

c) The function must be dependent on three distinct variables d) Both (a) and (b)

72. In the question number 64, the maximum acceleration of the collar is

a) 5 m s^{-2} b) 10 m s^2 c) 15 m s^{-2} d) 20 m s^{-2}

73. The length of the simple pendulum which ticks seconds is:

a) 0.5 m b) 1 m c) 1.5 m d) 2 m

74. The angle between particle velocity and wave velocity in a transverse wave is:

a) zero b) π/4 c) π/2 d) π

75. Which of the following expressions does not represent simple harmonic motion?

a) $x = A\cos\omega t + B\sin\omega t$ b) $x = A\cos(\omega t + \alpha)$ c) $x = B\sin(\omega t + \beta)$ d) $x = A\sin\omega t\cos^2\omega t$

76. In a stationary sound wave produced in air:

a) each air particle executes vibrations with the same amplitude

b) amplitude of vibration is maximum at some places c) air particles are stationary

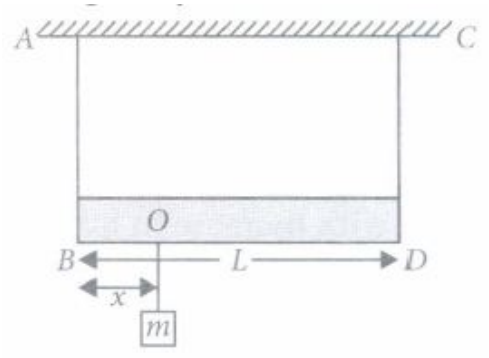
d) the particles do not execute periodic motion

77. Resonance is an example of
a) forced oscillation b) damped oscillation c) free oscillation d) none of these

78. The frequency of a tuning fork with an amplitude, A = 1cm is 250 Hz. The maximum velocity of any particle in air is equal to:
a) $\frac{5}{\pi} m/sec$ b) $5\pi m/sec$ c) $\frac{3.30}{\pi} m/sec$ d) none of these

79. A stationary wave $y = 0.4 \sin\frac{2\pi}{40} x \cos 100\pi t$ is produced in a rod fixed at both end. The minimum possible length of the rod is given by:
a) 10 m b) $20\sqrt{2}$ m c) 20 m d) 28 m

80. A massless rod of length L is suspended by two identical strings AB and CD of equal length. A block of mass m is suspended from point 0 such that BO is equal to 'x' Further it is observed that the frequency of 1st harmonic in AB is equal to 2nd harmonic frequency in CD, 'x' is



a) $\frac{L}{5}$ b) $\frac{4L}{5}$ c) $\frac{3L}{5}$ d) $\frac{L}{5}$

81. A sound wave of wavelength 90 em in glass is refracted into air. If the velocity of sound in glass is 5400 m/sec, the wavelength of the wave in air is:
a) 55 cm b) 5.5 cm c) 55 m d) 5.5 m

82. A sound wave travels with a velocity of 300 m s^{-1} through a gas. 9 beats are produced in 3 s when two waves pass through it simultaneously. If one of the waves has 2 m wavelength, the wavelength of the other wave is:
a) 1.98 m b) 2.04 m c) 2.06 m d) 1.99 m

83. The particle executing simple harmonic motion has a kinetic energy $K_0 \cos^2 \omega t$. The maximum values of the potential energy and the total energy are respectively,
a) $K_0/2$ and K_0 b) K_0 and 2 K_0 c) K_0 and K_0 d) 0 and 2 K_0

84. The angular velocity and the amplitude of a simple pendulum is ω and a respectively. At a displacement x from the mean position if its kinetic energy is T and potential energy is V, then the ratio of T to V is :
a) $(a^2-x^2\omega^2)/x^2\omega^2$ b) $x^2\omega^2/(a^2-x^2\omega^2)$ c) $(a^2-x^2)/x^2$ d) x^2/a^2-x^2

85. Mechanical wave (sound wave) in a gas is:
a) transverse b) longitudinal c) neither transverse nor longitudinal
d) either transverse or longitudinal

86. According to Newton's formula, the speed of sound in air at STP is
(Take the mass of 1mole of air is 29 x 10^{-3} kg)

a) 250 m S^{-1} b) 260 m S^{-1} c) 270 m S^{-1} d) 280 m S^{-1}

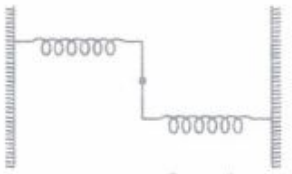
87. Two springs of spring constants k_1 and k_2 are joined in series. The effective spring constant of the combination is given by:

a) $k_1k_2/\left(k_1+k_2\right)$ b) k_1k_2 c) $\left(k_1+k_2\right)/2$ d) k_1+k_2

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

a) 100 Hz b) 99 Hz c) 96 Hz d) 103 Hz

89. A uniform rod of length l and mass M is pivoted at the centre. Its two ends are attached to two springs of equal spring constant k. The springs are fixed to rigid support as shown in figure and the rod is free to oscillate in the horizontal plane. The rod is gently pushed through a small angle e in one direction and released. The frequency of oscillation is



a) $\frac{1}{2\pi}\sqrt{\frac{2k}{6M}}$ b) $\frac{1}{2\pi}\sqrt{\frac{k}{M}}$ c) $\frac{1}{2\pi}\sqrt{\frac{6k}{M}}$ d) $\frac{1}{2\pi}\sqrt{\frac{24k}{M}}$

90. Out of the following functions, representing motion of a particle, which represents SHM?

$(A)y=\sin wt-\cos wt$

$(B)y=\sin^3 wt$

$(C)y=5\cos\left(\frac{3\pi}{4}-3\omega t\right)$

$(D)y=1+\omega t+\omega^2t^2$

a) Only (A) and (C) b) Only (A) and (B) c) only (A) d) Only (D) does not represent SHM

91. A light pointer fixed to one prong of a tuning fork touches a vertical plate. The fork is set vibrating and the plate is allowed to fall freely. Eight complete oscillations are counted when the plate falls through 10 cm. What is the frequency of the tuning fork?

a) 112 Hz b) 56 Hz c) 8/7 Hz d) 7/8 Hz

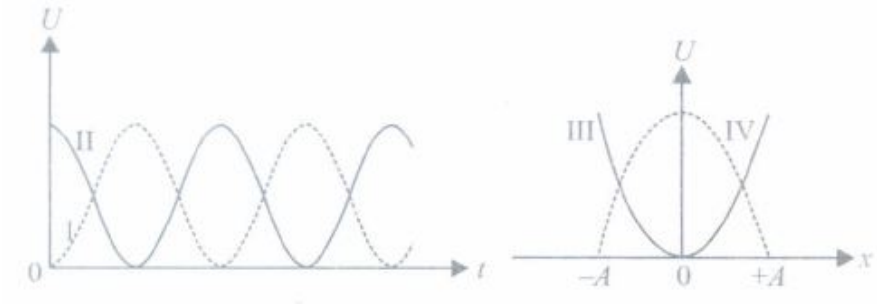
92. Assertion: Sound wave is an example of longitudinal wave.
Reason : In longitudinal waves, the constituents of the medium oscillate perpendicular to the direction of wave propagation.

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.

93. For a particle executing simple harmonic motion, the displacement x is given by x = Acos oot. Identify the graph, which represents the variation of potential energy (U) as a function of time t and displacement x.



a) 1, III b) II, III c) I, IV d) II, IV

94. When two coherent waves interfere, there is:
a) loss in energy b) gain in energy c) redistribution of energy which changes with time
d) redistribution of energy which does not change with time

95. A particle executes SHM of period 12 s. After two seconds, it passes through the centre of oscillation, the velocity is found to be 3.142 cm s- The amplitude of oscillations is
a) 6 crn b) 3 cm c) 24 crn d) 12 crn

96. A wave of wavelength 2 m is reflected from a surface. If a node is formed at 3 m from the surface, then at what distance from the surface, another node will be formed?
a) 1 m b) 2 m c) 3 m d) 4 m

97. If the temperature is raised by I K from 300 K, then the percentage change in the speed of sound in the gaseous mixture is: (R = 8.31 J/mol-K)
a) 0.167% b) 2% c) 1% d) 0.334%

98. Apparatus used to find out velocity of sound in gas is:
a) Melde's apparatus b) Kundt's tube c) Quincke's tube d) none of these

99. If wave $y = A\cos(\omega t + kx)$ is moving along z-axis, the shape of pulse at t = 0 and t = 2 sec :
a) are different b) are same c) may not be same d) none of these

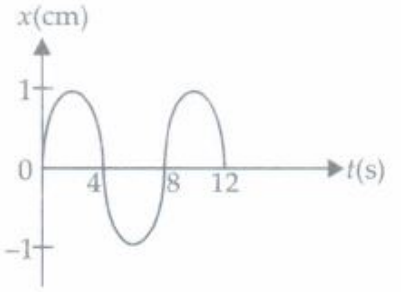
100. The equation of the propagating wave is, y = 25sin(20t + 5x), where y is displacement. Which of the following statements is not true?
a) The amplitude of the wave is 25 units.
b) The wave is propagating in positive X-direction. c) The velocity of the wave is 4 units.
d) The maximum velocity of the particles is 500 units.

101. Assertion: Two sinusoidal waves on the same string exhibit interference.
Reason: These waves, add or cancel out according to the principle of superposition
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.

102. The function sinω t- cosωt represents
a) a simple harmonic motion with a period $\frac{\pi}{\omega}$ b) a simple harmonic motion with a period $\frac{2\pi}{\omega}$
c) a periodic, but not simple harmonic motion with a period $\frac{\pi}{\omega}$

d) a periodic, but not simple harmonic motion WIth a period $\frac{2\pi}{\omega}$

103. The x-t graph of a particle undergoing simple harmonic motion is as shown in the figure.



The acceleration of the particle at $t = \frac{4}{3}s$

a) $\frac{\sqrt{3}}{32}\pi^2 cms^{-2}$ b) $-\frac{\pi^2}{32}cms^{-2}$ c) $\frac{\pi^2}{32}cms^{-2}$ d) $-\frac{\sqrt{3}}{32}\pi^2 cms^{-2}$

104. A progressive wave $y = A \sin(kx - \omega t)$ is reflected by a rigid wall at x =0. Then, the reflected wave can be represented by:

a) $y = A \sin(kx + \omega t)$ b) $y = A \cos(kx + \omega t)$ c) $y = -A \sin(kx - \omega t)$ d) $y = -A \sin(kx + \omega t)$

e) $y = A \cos(kx - \omega t)$

105. An echo is heard when minimum distance of the reflecting surface is:

a) 10 cm b) 17 m c) 34 m d) 340 m

106. In the following question, a statement of assertion is followed by a statement of reason. Mark the correct choice as :

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

107. The kinetic energy and potential energy of a particle executing S.H.M. will be equal, when displacement is : (amplitude = a)

a) a/2 b) $a\sqrt{2}$ c) $a/\sqrt{2}$ d) $a/\sqrt{2/3}$

108. The ratio of velocity of sound in hydrogen and oxygen at STP is:

a) 16:1 b) 8:1 c) 4:1 d) 2:1

109. A transverse wave is described by the equation $y = y_0 \sin 2\pi\left(ft - \frac{x}{\lambda}\right)$. The maximum particle velocity is equal to four times the wave velocity if:

a) $\lambda = \frac{\pi y_0}{4}$ b) $\lambda = \frac{\pi y_0}{2}$ c) $\lambda = \pi y_0$ d) $\lambda = 2\pi y_0$

110. If the bulk modulus of water is 2100 MPa, what is the speed of sound in water?

a) 1450 ms^{-1} b) 2100 ms^{-1} c) 1400 ms^{-1} d) 1200 ms^{-1}

111. Which one of the following equation of motion represents simple harmonic motion?

where k, k_0, k_1 and a are all positive

a) Acceleration =- k(x+a) b) Acceleration = k(x+a) c) Acceleration = kx
d) Acceleration = - $k_0x+k_1x_2$

112. If n_1, n_2 and n_3 are the fundamental frequencies of three segments into which a string is divided, then the original fundamental frequency n of the string is given by:
a) $1/n = 1/n_l + 1/n_2 + 1/n_3$ b) $1/\sqrt{n_1}+1/\sqrt{n_2}+1/\sqrt{n_3}$ c) $\sqrt{n}=\sqrt{n_1}+\sqrt{n_2}+\sqrt{n_3}$ d) $n=n_1+n_2+n_3$

113. A tuning fork whose frequency as given by manufacturer is 512 Hz is being tested with an accurate oscillator. It is found that the fork produces a beat of 2 Hz when oscillator reads 514 Hz but produces a beat of 6 Hz when oscillator reads 510 Hz. The actual frequency of fork is:
a) 508 Hz b) 512 Hz c) 516 Hz d) 518 Hz

114. In the following questions, a statement of assertion is followed by a statement of reason. Mark the correct choice as :
Assertion: The graph of total energy of a particle in SHM with respect to position is a straight line with zero slope.
Reason : Total energy of particle in SHM remains constant throughout its 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

115. For production of beats the two sources must have
a) Different frequencies and same amplitude b) Different frequencies
c) Different frequencies, same amplitudes and same phase
d) Different frequencies and same phase

116. Assertion : Speed of mechanical wave in the medium depends on the velocity of source, relative to an observer at rest.
Reason: Speed of mechanical wave is independent of the elastic and other properties such as mass density of the medium.
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.

117. When sound propagates through a medium, say air, the particles of the medium in a particular region undergo:
a) only compression throughout the time b) only rarefaction throughout the time
c) successive compression or rarefaction
d) sometimes compression, sometimes rarefaction

118. In a stationary wave pattern that forms as a result of reflection of waves from an obstacle the ratio of the amplitudes at antinodes and a node is β= 1.5. The percentage of energy that passes across the obstacle is :
a) 96% b) 4% c) 94% d) 6%

119. When a guitar is sounded with a 440 Hz tuning fork, a beat frequency of 5 Hz is heard. If the experiment is repeated with a tuning fork of 437Hz, the beat frequency is 8 Hz. The string frequency (in Hz) is:
a) 445 b) 435 c) 429 d) 448

120. In simple harmonic motion, at the extreme positions
a) kinetic energy is minimum, potential energy is maximum.
b) kinetic energy is maximum, potential energy is minimum.
c) both kinetic and potential energies are maximum
d) both kinetic and potential energies are minimum

121. Two pendulums begin to swing simultaneously. The first pendulum makes 9 full oscillations when the other makes 7. The ratio of lengths of the two pendulums is:
a) 9/7 b) 7/9 c) 49/81 d) 81/49

122. A stationary source is emitting sound at a fixed frequency fo' which is reflected by two cars approaching the source. The difference between the frequencies of sound reflected from the cars is 1.2 % of fo' What is the difference in the speeds of the cars (in km per hour) to the nearest integer? The cars are moving at constant speeds much smaller than the speed of sound which is 330 ms^{-1}.
a) 2 b) 3 c) 5 d) 7

123. The frequency of tuning fork A is 2% more than the frequency of a standard tuning fork. The frequency of a tuning fork B is 3% less than the frequency of same standard tuning fork. If 6 beats per second are heard when the two tuning forks A and B are excited, the frequency of A is:
a) 120 Hz b) 122.4 Hz c) 116.4 Hz d) 130 Hz

124. A wave of frequency 100 Hz is sent along a string towards a fixed end. 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 speed of incident (and reflected) wave _____ .
a) 5 m/s b) 10 m/s c) 20 m/s d) 40 m/s

125. Which of the following properties of a wave does not change with a change in medium?
a) Frequency b) Wavelength c) Velocity d) Amplitude

126. For the travelling harmonic wave
$y(x, t) = 2\cos 2\pi(10t - 0.008x + 0.35)$ where x and y are in em and t is in s. The phase difference between oscillatory motion of two points separated by a distance of 0.5 m is
a) 0.2π rad b) 0.4π rad c) 0.6π rad d) 0.8π rad

127. If we study the vibration of a pipe open at both ends, then the following statement is not true:
a) Pressure change will be maximum at both ends b) Open ends will be antinode
c) Odd harmonics of the fundamental frequency will be generated
d) All harmonics of the fundamental frequency will be generated

128. The equation of stationary wave along a stretched string is given by: $y = 5\sin\frac{\pi x}{3}\cos 40\pi t$ where x and y are in centimetre and t in second. The separation between two adjacent nodes is:
a) 6 cm b) 4 cm c) 3 cm d) 1.5 cm

129. A block of mass m is attached to one end of a massless spring which is suspended vertically from a fixed point. The mass is held in hand so that the spring is neither stretched nor compressed. Suddenly the support of the hand is removed. The lowest position attained by the mass during oscillation is 4 cm below the point, where it was held in hand. The amplitude of the oscillation is

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

130. A particle executing SHM with time period T and amplitude A. The mean velocity of the particle averaged over quarter oscillation is

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

131. A simple pendulum performs simple harmonic motion about x = 0 with an amplitude a and time period T. The speed of the pendulum at x = a/2 will be:

a) πa/T b) 3π2a/T c) πa$\sqrt{3}$/T d) πa$\sqrt{3/2}$/T

132. The phase difference between two waves, represented by

$Y_1 = 10^{-6}\sin\{100t + (x/50) + 0.5\}\text{m}$

$Y_2 = 10^{-6}\cos\{100t + (x/50)\}\text{m}$

where r is expressed in metres and t is expressed in seconds, is approximately

a) 1.5 radians b) 1.07 radians c) 2.07 radians d) 0.5 radians

133. A person is observing two trains one coming towards him and other leaving with the same velocity 4 m/s. If their whistling frequencies are 240 Hz each, then the number of beats per second heard by the person will be: (if velocity of sound is 320 m/s)

a) 3 b) 6 c) 9 d) zero

134. A simple harmonic motion has an amplitude A and time period T. The time required by it to travel from x = A to x = A/2 is:

a) T/6 b) T/4 c) T/3 d) T/2

135. A car is moving with a speed of 72 km/h towards a hill. Car blows horn at a distance of 1800 m from the hill. If echo is heard after 10 s, the speed of sound (in m/s) is:

a) 300 b) 320 c) 340 d) 360

136. The phenomenon of beats can take place

a) for longitudinal waves only b) for transverse wave only c) for sound waves only

d) for both longitudinal and transverse waves

137. Assertion: The interference of two identical waves moving in same direction produces standing waves.

Reason: Various elements of standing waves do not remain in constant phase

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.

138. Assertion: In a stationary wave, no transfer of energy takes place.
Reason: There is no onward motion of the disturbance from one particle to adjoining particle in a stationary wave.
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.

139. If the velocity of wave is 360 m/s and frequency 500 Hz, the path difference corresponding to 60° phase difference is:
a) 10 cm b) 12 cm c) 15 cm d) 72 cm

140. Three waves of amplitudes $12\mu m, 4\mu m$ and $9\mu m$ but of same frequency arrive at a point in a medium with the successive phase difference of (π/ 2). Then, the resultant amplitude in μm is :
a) 4 b) 7 c) 5 d) 25

141. Newton assumed that sound propagation in a gas takes under
a) isothermal condition b) adiabatic condition c) isobaric condition
d) isentropic condition

142. If a note x of unknown frequency produces 8 beats/see, with a source of 250 Hz and 12 beats/see with a source of 270 Hz, the frequency of unknown source will be:
a) 258 Hz b) 242 Hz c) 262 Hz d) 282 Hz

143. The principle of superposition in wave motion tells that in a motion in which two or more waves are simultaneously producing their displacement in a particle along the same line, then the resultant:
a) amplitude is the sum of the individual amplitudes
b) velocity is the sum of the individual velocities
c) displacement is the sum of the individual displacements
d) phase is the sum of the individual phases

144. The maximum particle velocity in a wave motion is half the wave velocity, then the amplitude of the wave is equal to:
a) $\lambda/4\pi$ b) $2\lambda/\pi$ c) $\lambda/2\pi$ d) λ

145. A body of mass 20 g connected to a spring of spring constant k, executes simple harmonic motion with a frequency of (5/π) Hz. The value of spring constant is:
a) 4 Nm^{-1} b) 3 Nm^{-1} c) 2 Nm^{-1} d) 5 Nm^{-1}

146. Which of the following is the example of transverse wave?
a) Sound waves b) Compressional waves in a spring
c)
In a transverse wave, the particles of the medium oscillate in a direction perpendicular to the direction of propagation
d) All of these

147. The 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 sound in the medium is 350 m/s :

a) 750 Hz b) 857 Hz c) 1143 Hz d) 1333 Hz

148. In the following questions, a statement of assertion is followed by a statement of reason. Mark the correct choice as :

Assertion : If the amplitude of a simple harmonic oscillator is doubled, its total energy becomes double.

Reason: The total energy is directly proportional to the amplitude of vibration of the harmonic oscillator.

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

149. Two waves of frequencies 20 Hz and 30 Hz travel out from a common point. How will they differ in phase at the end of 0.75 sec?

a) 15π b) π c) 7π d) 2π

150. A block of mass 2 kg is attached to the spring of spring constant 50 N m^{-1}. The block is pulled to a distance of 5 cm from its equilibrium position at x = 0 on a horizontal frictionless surface from rest at t = O. The displacement of the block at any time t:

a) x = 0.05 sin 5t m b) x = 0.05 cos 5t m c) x = 0.5 sin 5t m d) x = 5 sin 5t m

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

a) a phase change of 1800 with velocity reversed

b) the same phase as the incident pulse with no reversal of velocity

c) a phase change of 180° with no reversal of velocity

d) the same phase as the incident pulse but with velocity reversed.

152. A standing wave is produced in a string fixed at both ends. In this case:

a) all particles vibrate in phase b) all antinodes vibrate in phase

c) all alternate antinodes vibrate in phase

d) all particles between two consecutive antinodes vibrate in phase

153. A body of mass 5 gm is executing S.H.M. about a point with amplitude 10 cm. Its maximum velocity is 100 cm/sec. Its velocity will be 50 cm/sec, at a distance

a) 5 b) $5\sqrt{2}$ c) $5\sqrt{3}$ d) $10\sqrt{2}$

154. A simple harmonic oscillator has a period T and energy E. The amplitude of the oscillator is doubled. Choose the correct answer.

a) Period and energy get doubled. b) Period gets doubled while energy remains the same

c) Energy gets doubled while period remains the same

d) Period remains the same and energy becomes four times.

155. Choose the correct statement

a) Beats are due to destructive interference

b) Maximum beat frequency audible to a human being is 20.

c) Beats are as a result of Doppler's effect.

d) Beats are due to superposition of two waves of nearly equal frequencies.

156. When sound wave is refracted from air to water which of the following quantities remains unchanged?
a) Wavelength b) Wave number c) Wave velocity d) Frequency

157. In two similar wires of tensions 16 N and T, 3 beats are heard; then T is :
a) 49 N b) 6 N c) 25 N d) none of these

158. Velocity of sound waves in air is 330 m/s. For a particular sound in air, a path difference of 40 cm is equivalent to a phase difference of 1.6π. The frequency of the wave is:
a) 160 Hz b) 150 Hz c) 660 Hz d) 330 Hz

159. The complete destructive interference of two sound waves takes place when the two waves are travelling in the same direction:
a) with the same frequency and amplitude and are in phase

b) with the same frequency and amplitude and are in opposite phase

c) with the same frequency and amplitude d) with the same frequency and opposite phase

160. In the following question, a statement of assertion is followed by a statement of reason. Mark the correct choice as :
Assertion: In the ideal case of zero damping, the amplitude of simple harmonic motion at resonance is infinite.
Reason: All real systems have some damping
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

161. Three sound waves of equal amplitudes have frequencies (n - 1), n, (n + 1). They superimpose to give beats. The number of beats produced per second will be :
a) 1 b) 4 c) 3 d) 2

162. String A has a length L, radius of cross-section r, density of material p and is under tension T. String B has all these quantities double those of string A. If v_A and v_B are the corresponding fundamental frequencies of the vibrating string, then
a) $v_A=2v_B$ b) $v_A=4v_B$ c) $v_B=4v_A$ d) $v_A=v_B$

163. A transverse wave is represented by y = Asin(ωt - kx). For what value of the wavelength is the wave velocity equal to the maximum particle velocity?
a) $\frac{\pi}{2}$ b) πA c) 2πA d) A

164. Two identical piano wires kept under the same tension 7 have a fundamental frequency of 600 Hz. The fractional increase in the tension of one of the wires which will lead to occurrence of 6 beats/s when both the wires oscillate together would be:
a) 0.02 b) 0.03 c) 0.04 d) 0.01

165. For the stationary wave: $y = 4\sin(\pi x/15)\cos(96\pi t),$ the distance between a node and the next antinode is:
a) 7.5 b) 15 c) 22.5 d) 30

166. The equation for a transverse wave travelling along the positive x-axis with amplitude 0.2 m, velocity v=360 ms^{-1} and wavelength l=60 m can be written as _____ .

a) $y = 0.2\sin\left[2\pi\left(6t - \frac{x}{60}\right)\right]$ b) $y = 0.2\sin\left[\pi\left(6t + \frac{x}{60}\right)\right]$ c) $y = 0.2\sin\left[\pi\left(6t - \frac{x}{60}\right)\right]$

d) $y = 0.2\sin\left[2\pi\left(6t + \frac{x}{60}\right)\right]$

167. Any periodic function can be expressed as a superposition of sine and cosine functions of different time periods with suitable coefficients. Which of the following mathematicians proved this result?

a) Pythagoras b) Carl Friedrich Gauss c) Leonhard Euler

d) Jean Baptiste Joseph Fourier

168. A mass oscillates along the x-axis according to the law, $x = x_0\cos\left(\omega t - \frac{\pi}{4}\right)$. If the acceleration of the particle is written as $a = A\cos(\omega t + \delta)$ then

a) $A = x_0\omega^2, \delta = \frac{3\pi}{4}$ b) $A = x_0, \delta = -\frac{\pi}{4}$ c) $A = x_0\omega^2, \delta = \frac{\pi}{4}$ d) $A = x_0\omega^2, \delta = -\frac{\pi}{4}$

169. The panicles of a medium vibrate about their mean positions whenever a wave travels through that medium. The phase difference between the vibratons of two such particles:

a) varies with time b) varies with distance separating them

c) varies with time as well as distance d) is always zero

170. In stationary waves, nodes are the points where there is :

a) minimum displacement and minimum pressure change

b) minimum displacement and maximum pressure change

c) maximum displacement and maximum pressure change

d) maximum displacement and minimum pressure change

171. A motorcyclist is moving towards a stationary car which is emitting a sound of 165 Hz and a police car is chasing the motorcyclist blowing siren at frequency 172 Hz. If speed of police car is 22 m/s, then speed of motorcyclist for which the motorcyclist hears no beats is:

a) 33 m/s b) 22 m/s c) 11 m/s d) zero

172. If x, v and a represent the displacement, the velocity and the acceleration of a particle executing simple harmonic motion of time period T then which of the following does not change with time?

a) $\frac{\alpha T}{v}$ b) $\alpha T + 2\pi v$ c) $\frac{\alpha T}{x}$ d) $\alpha^2 T + 4\pi^2 v^2$

173. A transverse wave is represented by the equation

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

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

a) $\lambda = 2\mathrm{p}y_0$ b) $\lambda = \frac{\pi y_0}{3}$ c) $\lambda = \frac{\pi y_0}{2}$ d) $\lambda = \pi y_0$

174. If a simple harmonic motion is represented by $\frac{d^2}{dt^2} + \alpha x = 0$ time period is

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

175. When the potential energy of a particle executing simple harmonic motion is one-fourth of the maximum value during the oscillation, its displacement from the equilibrium position in terms of amplitude 'a' is :
a) a/4 b) a/3 c) a/2 d) 2a/3

176. Which of the following statements is correct for waves?
a) Nodes and antinodes are formed in case of transverse stationary waves only
b) Nodes and antinodes are formed in case of longitudinal stationary waves only
c) Nodes and antinodes are formed in case of all the stationary waves
d) None of the above

177. Sound waves from a whistle of frequency 1100 Hz reach a point by two different paths. When the paths differ by 15 cm or 45 cm there is silence at that point. The speed of sound is:
a) 1100 x 15 cm/s b) 1100 x 30 cm/s c) 1100 x 45 cm/s d) 1100 x 60 cm/s

178. When two displacement represented by $y_1 = a\sin(\omega t)$ and $y_2 = b\cos(\omega t)$ are superimposed the motion is :
a) simple harmonic with amplitude $\frac{a}{b}$ b) simple harmonic with amplitude $\sqrt{a^2 + b^2}$
c) simple harmonic with amplitude $\frac{(a+b)}{2}$ d) not a simple harmonic

179. The velocities of sound in an ideal gas at temperatures T_1 and T_2 K are found to be V_1 and V_2 respectively. If the root mean square speeds of the same gas at the same temperatures T_1 and T_2 are v_1 and v_2 respectively, then:
a) $v_2 = v_1(V_2/V_1)$ b) $v_2 = v_1(V_1/V_2)$ c) $v_2 = v_1\sqrt{V_2/V_1}$ d) $v_2 = v_1\sqrt{V_1/V_2}$

180. A tuning fork of unknown frequency makes 3 beats/sec with a standard fork of frequency 384Hz. The beat frequency decreases when a small piece of wax is put on the prong of the first. The frequency of the fork is:
a) 387 Hz b) 381 Hz c) 384 Hz d) 390 Hz

181. A sinusoidal travelling wave is described as linear combination of sine and cosine functions as follows:$y(x, t) = 4\sin(kx - \omega t) + 3\cos(kx - \omega t)$The sinusoidal wave can be described as :

a) $y(x, t) = 5\sin(kx - \omega t + \phi)$ *where* $\phi = \tan^{-1}\left(\frac{3}{4}\right)$ b) $y(x, t) = 5\sin(kx - \omega t)$

c) $y(x, t) = 5\sin\left(kx - \omega t + \frac{\pi}{3}\right)$ d) both (a) and (b)

182. Two waves have equations: $x_1 = a\sin\left(\omega t + \phi_1\right)$ and $x_2 = a\sin\left(\omega t + \phi_2\right)$. If in the resultant wave the frequency and amplitude remain equals to amplitude of superimposing waves, the phase difference between them is:
a) $\frac{\pi}{6}$ b) $\frac{2\pi}{3}$ c) $\frac{\pi}{4}$ d) $\frac{\pi}{3}$

183. 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) Four nodes and three antinodes b) Four nodes and four antinodes
c) Three nodes and three antinodes d) Three nodes and four antinodes

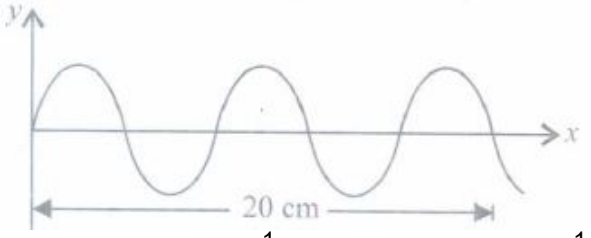
184. A simple pendulum is suspended from the roof of a trolley which moves in a horizontal direction with an acceleration a. then the time period is given by $T = 2\pi\sqrt{\left(\frac{1}{g}\right)}$ where g is equal to:
a) g b) g-a c) g+a d) $\sqrt{\left(g^2 + \alpha^2\right)}$

185. The speed of a wave on a string is 150 m/s when the tension is 120 N. The percentage increase in the tension in order to raise the wave speed by 20% is:
a) 44% b) 40% c) 20% d) 10%

186. If the pressure amplitude of a sound wave is tripled, then by what factor the intensity of the sound wave is increased?
a) 3 b) 6 c) 9 d) $\sqrt{3}$

187. Two waves of the same frequency, travelling in the same medium but in opposite directions if superposed give rise to:
a) resonance b) beats c) standing waves d) harmonics

188. Figure given shows a sinusoidal wave on a string. If the frequency of the wave is 150 Hz, what is the velocity and wavelength of the given wave?



a) 0.04 m, 10 m s^{-1} b) 0.06 m, 12 m s^{-1} c) 0.08 m, 10 m s^{-1} d) 0.08 m, 12 m s^{-1}

189. Which of the following is true regarding beats?
a) Frequency different, amplitude same b) Frequency same, amplitude same
c) Frequency same, amplitude same d) None of the above

190. The periodic time of a mass suspended by a spring (force constant k) is T. If the spring is cut in three equal pieces, what will be the force constant of each part and what will be the periodic time, if the same mass is suspended from one piece?
a) k,T$\sqrt{3}$ b) 3k,T c) 3k. d) 3k,T$\sqrt{3}$

191. Distance between successive compressions and rarefactions is 1m and velocity of sound is 360 m s^{-1}. Find frequency:

a) 180 Hz b) 45 Hz c) 120 Hz d) 90 Hz

192. The velocity of sound in any gas depends upon:
a) wavelength of sound b) density and elasticity of gas c) intensity of sound waves
d) amplitude and frequency of sound

193. When a sound wave of wavelength λ is propagating in a medium, the maximum velocity of the particle is equal to the wave velocity. The amplitude of wave is:
a) λ b) $\frac{\lambda}{2}$ c) $\frac{\lambda}{2\pi}$ d) $\frac{\lambda}{4\pi}$

194. The displacement y of a wave travelling in the X-direction is given by:
$y = 10^4 \sin\left(600t - 2x + \frac{\pi}{3}\right) meters,$ where x is expressed in metres and t in seconds. The speed of the wave motion is:
a) 200 m/s b) 300 m/s c) 600 m/s d) 1200 m/s

195. A travelling wave represented by $y(x, t) = a\sin(kx - \omega t)$ is superimposed on another wave represented by $y(x, t) = a\sin(kx + \omega t)$. The resultant is a :
a) standing wave having nodes at $x = \left(n + \frac{1}{2}\right)\frac{\lambda}{2};$ n =0,1,2,.....
b) standing wave having nodes at $x = n\frac{\lambda}{2};$ n=0,1,2, ...
c) wave travelling along + x-direction d) wave travelling along - x-direction

196. A body sends waves 100 mm long through medium A and 0.25 m long in medium B. If the velocity of waves in medium A is 80 cm S^{-1}. The velocity of waves in medium B is
a) 1 m S^{-1} b) 2 m S^{-1} c) 3 m S^{-1} d) 4 m S^{-1}

197. Two sound waves with wavelength 5.0 m and 5.5 m respectively, each propagate in a gas with velocity 330 m/s. We expect the following number of beats per second.
a) 0 b) 1 c) 6 d) 12

198. The amplitude of a pendulum executing damped simple harmonic motion falls to 1/3 the original value after 100 oscillations. The amplitude falls to S times the original value after 200 oscillations, where S is:
a) 1/9 b) 1/2 c) 2/3 d) 1/3

199. In a sports meet, the timing of a 200-metre straight dash is recorded at the finish point by starting an accurate stopwatch on hearing the sound of starting gun fired at the starting point. The time recorded will be more accurate:
a) in winter b) in summer c) in all seasons d) none of these

200. What is the maximum possible sound level of sound waves in air? Given that density of air = 1.3 kg/m^3, v =332 m/s and atmospheric pressure = 1.01 x 10^5 N/m^2:
a) 120 dB b) 60 dB c) 190 dB d) 50 dB

201. Which one of the following statements is true for the speed 'v' and the acceleration 'a' of a particle executing simple harmonic motion:
a) Value of a is zero, whatever may be the value of 'v' b) When 'v' is zero, a is zero
c) When 'v' is maximum, a is zero d) When 'v' is maximum, a is maximum

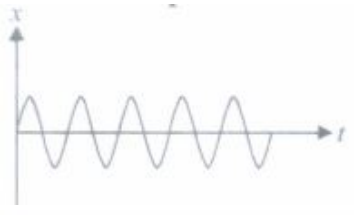
202. It is possible to distinguish between transverse and longitudinal waves by studying the property of:
a) interference b) diffraction c) reflection d) polarization

203. A body executes SHM with an amplitude a. At what displacement from the mean position, the potential energy of the body is one-fourth of its total energy?
a) $\frac{a}{4}$ b) $\frac{a}{2}$ c) $\frac{3a}{4}$ d) Some other fraction of a

204. If the pressure amplitude in a sound Wave is tripled, then the intensity of sound is increased by a factor of:
a) 6 b) 3 c) 9 d) $\sqrt{3}$

205. The disc of a siren containing 60 holes rotates at a constant speed of 360 rpm. The emitted sound is in unison with a tuning fork of frequency:
a) 10 Hz b) 360 Hz c) 216 Hz d) 6 Hz

206. Which of the following displacement-time graphs represent damped harmonic oscillation?

a) 

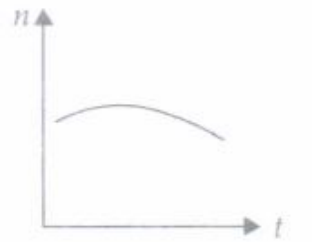
b) 

c) 

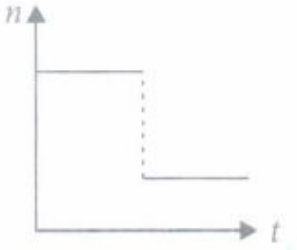
d) 

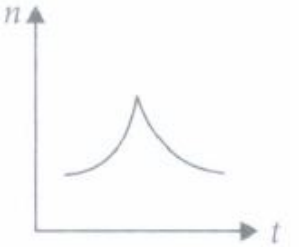
207. The stationary wave y = 2a sinkx cosωt in a stretched string is the result of superposition of Y_1 = a sin(kx - ωt) and
a) Y_2 = a cos(kx + ωt) b) Y_2 = a sin(kx + ωt) c) Y_2 = a cos(kx - ωt) d) Y_2 = asin(kx - ωt)

208. A train whistling at constant frequency is moving towards a station at a constant speed v. The train goes past a stationary observer on the station. The frequency n of the sound as heard by the observer is plotted as a function of time t. Identify the expected curve.

a) 

b) 

c) 

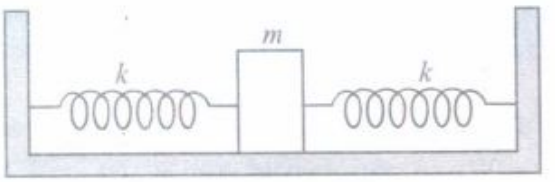
d) 

209. Two radio stations broadcast their programmes at the same amplitude A and at slightly different frequencies ω_1 and ω_2 respectively, where $\omega_2 - \omega_1 = 10^3$ Hz. A detector is receiving signals from the two stations simultaneously. It can only detect signals of intensity > $2A^2$. The time interval between successive maxima of the intensity of the signal received by the detector is:
a) 10^3 sec b) 10^{-3} sec c) 10^{-4} sec d) 10^4 sec

210. The velocities of sound at the same temperature in two monoatomic gases of densities ρ_1 and ρ_2 are v_1 and v_2 respectively. If $\rho_1/\rho_2 = 4$, then the value of v_1/v_2 is:
a) $\frac{1}{4}$ b) $\frac{1}{2}$ c) 2 d) 4

211. A particle executing simple harmonic motion with an amplitude A and angular frequency ω. The ratio of maximum acceleration to the maximum velocity of the particle is
a) ωA b) $\omega^2 A$ c) ω d) $\frac{\omega^2}{A}$

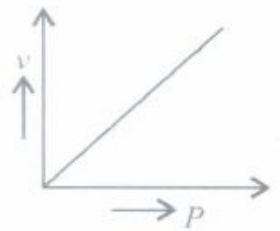
212. Two identical springs of spring constant k are attached to a block of mass m and to fixed supports as shown in the figure. The time period of oscillation IS

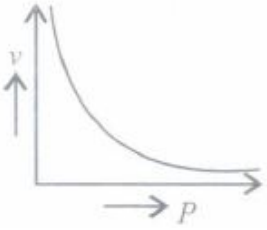


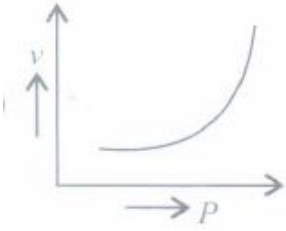
a) $2\pi\sqrt{\frac{m}{k}}$ b) $2\pi\sqrt{\frac{m}{2k}}$ c) $2\pi\sqrt{\frac{2m}{k}}$ d) $\pi\sqrt{\frac{m}{k}}$

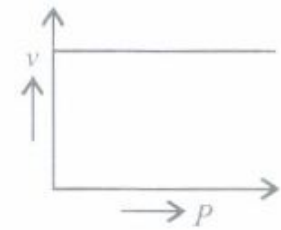
213. In a gas, two waves of wavelengths 1 m and 1.01 m are superposed and produce 10 beats in 3 seconds. The velocity of sound in the medium is:
a) 300 m/s b) 336.7 m/s c) 360.2 m/s d) 270 m/s e) 390 m/s

214. A student plotted the following four graphs representing the variation of velocity of sound in a gas with the pressure P. Which one is correct?

a) 

b) 

c) 

d) 

215. The time of reverberation of a room A is one second. What will be the time (in seconds) of reverberation of a room, having all the dimension double of those of room A?
a) 4 b) $\frac{1}{2}$ c) 1 d) 2

216. Of the materials mentioned below the speed of sound is the largest in:

a) water b) steel c) vacuum d) air

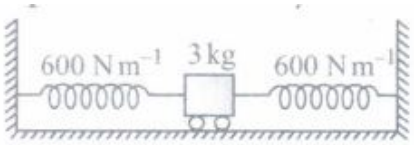
217. A particle executing SHM has a maximum speed of 30 cm s^{-1} and a maximum acceleration of 60 cm s^{-2}. The period of oscillation is:

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

218. A block of mass m is attached to a spring of spring constant k and has a natural frequency ω_0. An external force pet) proportional to $\cos\omega t\left(\omega \neq \omega_0\right)$ is applied to the oscillator. The time displacement of the oscillator will be proportional to

a) $\frac{m}{\omega_0^2-\omega^2}$ b) $\frac{1}{m\left(\omega_0^2-\omega^2\right)}$ c) $\frac{1}{m\left(\omega_0^2-\omega^2\right)}$ d) $\frac{m}{\omega_0^2-\omega^2}$

219. A trolley of mass 3 kg, as shown in figure, is connected to two identical springs, each of spring constant 600 N m^{-1}. If the trolley is displaced from its equilibrium position by 5 cm and released, the maximum speed of the trolley is



a) 0.5 m s^{-1} b) 1 m s^{-1} c) 2 m s^{-1} d) 3 m s^{-1}

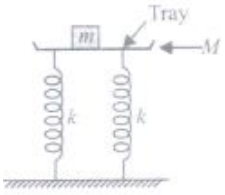
220. The frequency of tuning fork is 256 Hz. It will not resonate with a fork of frequency
a) 768 Hz b) 738 Hz c) 512 Hz d) 256 Hz

221. In an organ pipe of length L open at both ends, the fundamental mode has a frequency (where v is a speed of sound in air)

a) $\frac{v}{2L}$and only odd harmonics are present. b) $\frac{v}{2L}$and only even harmonics are present.

c) $\frac{v}{2L}$and all harmonics are present. d) $\frac{v}{4L}$ and only odd harmonics are present.

222. A tray of mass M = 10 kg is supported on two identical springs, each of spring constant k, as shown in figure When the tray is depressed a little and released, it executes simple harmonic motion of period 1.5 s. When a block of mass m is placed on the tray, the period of oscillation becomes 3 s. The value of m is



a) 10 kg b) 20 kg c) 30 kg d) 40 kg

223. Two particles execute Simple harmonic motions of same amplitude and frequency along the same straight line. They cross one another when going opposite directions. The phase difference between them when their displacements are one half of their amplitudes is
a) 60° b) 30° c) 120° d) 150°

224. A bomb explodes on the,moon. How long will it take for the sound to reach the earth?
a) 10 sec b) 1000 sec c) 1 day d) None of these

225. The displacement of a particle executing simple harmonic motion is given by
$y = A_0 + A\sin wt + B\cos wt$. Then the amplitude of its oscillation is given by:

a) $\sqrt{A^2 + B^2}$ b) $\sqrt{A_0^2 + (A + B)^2}$ c) $A + B$ d) $A_0 + \sqrt{A^2 + B^2}$

226. Two turning forks of frequencies n_1 and n_2 produces n beats per second. If n_2 and n are known, n_1 may be given by
a) $\frac{n_2}{n} + n_2$ b) $n_2 n$ c) $n_2 \pm n$ d) $\frac{n_2}{n} - n_2$

227. If amplitude of waves at distance r from a point source is A, the amplitude at a distance 2r will be:
a) 2A b) A c) A/2 d) A/4

228. A travelling wave in a gas along the positive X-direction has an amplitude of 2 cm, velocity 45 m/s and frequency 75 Hz. Particle acceleration after an interval of 3 sec at a distance of 135 cm from the origin is:
a) 0.44 x 10^2cm/s^2 b) 4.4 x 10^5cm/s^2 c) 4.4 x 10^3cm/s^2 d) 44 x 10^5cm/s^2

229. If the temperature of atmosphere is increased the following character of sound waves is effected:
a) amplitude b) frequency c) velocity d) wavelength

230. Two periodic waves of intensities I_1 and I_2 pass through a region at the same time in the same direction. The sum of the maximum and minimum intensities is :
a) $2(I_1+I_2)$ b) I_1+I_2 c) $(\sqrt{I_1} + \sqrt{I_2})^2$ d) $(\sqrt{I_1} - \sqrt{I_2})^2$

231. A window whose area is 2 m^2 opens on a street where street noises result in an intensity level at the window of 60 dB. How much acoustic power enters the window via sound waves and if an acoustic absorber is fitted at the window, how much energy from street noise will it collect in five hours?
a) $3\mu W, \quad 2 \times 10^{-3} J$ b) $2\mu W, \quad 36 \times 10^{-3} J$ c) $36\mu W, \quad 2 \times 10^{-3} J$ d) $2\mu W, \quad 3.6 \times 10^{-3} J$

232. A sound wave of wavelength λ, travels towards the right horizontally with a velocity V. It strikes and reflects from a vertical plane surface, travelling at a speed v towards the left. The number of positive crests striking in a time interval of three seconds on the wall is:
a) $3(V + v)/\lambda$ b) $3(V - v)/\lambda$ c) $(V + v)/3\lambda$ d) $(V - v)/3\lambda$

233. When two displacements represented by y_1 = a sin (ωt) and y_2 = b cos (ωt)are superimposed the motion is :
a) not a simple harmonic b) simple harmonic with amplitude a/b
c) simple harmonic with amplitude $\sqrt{a^2 + b^2}$ d) simple harmonic with amplitude (a+b)/2

234. A particle executing SHM with an amplitude A. The displacement of the particle when its potential energy is half of its total energy is
a) $\frac{A}{\sqrt{2}}$ b) $\frac{A}{2}$ c) $\frac{A}{4}$ d) $\frac{A}{3}$

235. In the following question, a statement of assertion is followed by a statement of reason. Mark the correct choice as :
Assertion: A child in a garden swing periodically presses his feet against the ground to maintain the oscillations.
Reason : All free oscillations eventually die out because of the ever present damping force.

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

236. In case of a travelling wave the reflection at a rigid boundary will take place with a phase change of :

a) $\frac{\pi}{2} radian$ b) $\frac{\pi}{4} radian$ c) $\frac{\pi}{6} radian$ d) π radian

237. If the density of air at NTP is 1.293 kg/m^3 and γ = 1.41, then the velocity of sound in air at NTP is:

a) 102.3 m/s b) 252.3 m/s c) 332.3 m/s d) 432.3 m/s

238. A point performs simple harmonic oscillation of period T and the equation of motion is given by x = a sin (ωt + π/6). After the elapse of what fraction of the time period the velocity of the point will be equal to half of its maximum velocity?

a) T/12 b) T/8 c) T/6 d) T/3

239. How long after the beginning of motion is the displacement of a harmonically oscillating point equal to one half its amplitude, if the period is 24 see and initial phase is zero?

a) 12 see b) 2 see c) 4 sec d) 6 see

240. When the displacement of a particle executing SHM is one-fourth of its amplitude, what fraction of the total energy is the kinetic energy?

a) $\frac{16}{15}$ b) $\frac{15}{16}$ c) $\frac{3}{4}$ d) $\frac{4}{3}$

241. Two oscillations: $x_1 = A\sin\omega t$ and $x_2 = A\cos\omega t$. Superimpose at right angles in x and y-axis respectively. What will be the resultant wave form?

a) Ellipse b) Straight line c) Circle d) Sinusoidal

242. A wave in a string has an amplitude of 2cm. The wave travels in the + ve direction of axis with a speed of 128 m/ sec and it is noted that 5 complete waves fit in 4 m length of the string. The equation describing the wave is _____ .

a) $y = (0.02)\text{m}\sin(15.7x - 2010t)$ b) $y = (0.02)\text{m}\sin(15.7x + 2010t)$

c) $y = (0.02)\text{m}\sin(7.85x - 1005t)$ d) $y = (0.02)\text{m}\sin(7.85x + 1005t)$

243. The distance between maximum and the next minimum displacement in a wave is 6 cm. The wavelength of the wave would be:

a) 6 cm b) 3 cm c) 12 cm d) 24 cm

244. A spring balance has a scale that reads from 0 to 50 kg. The length of the scale is 20 cm. A block of mass m is suspended from this balance, when displaced and released, it oscillates with a period 0.5 s. The value of m is (Take g = 10 m s^{-2})

a) 8 kg b) 12 kg c) 16 kg d) 20 kg

245. Sound waves in air are always longitudinal, because:

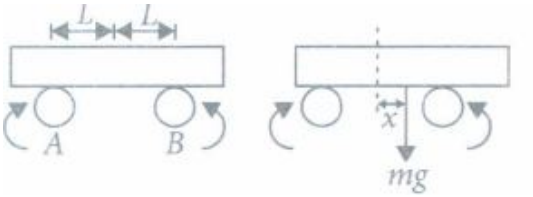
a) density of air is very small b) air is a mixture of several gases

c) air does not have a modulus of rigidity

d) of the inherent characteristics of sound waves in air

246. Two tuning forks, A and B, produce notes of frequencies 258 Hz and 262 Hz. An unknown note sounded with A produces certain beats. When the same note is sounded with B, the beat frequency gets doubled. The unknown frequency is
a) 250 Hz b) 252 Hz c) 254 Hz d) 256 Hz

247. A uniform bar with mass m lies symmetrically across two rapidly rotating fixed rollers, A and B with distance L = 2.0 cm between the bar's centre of mass and each roller. The rollers, whose directions of rotation are shown in figures slip against the bar with coefficient of kinetic friction llk = 0.40. Suppose the bar is displaced horizontally by a distance x as shown in figure and then released. The angular frequency co of the resulting horizontal simple harmonic motion of the bar is (in rad s^{-1})



a) 14 b) 15 c) 16 d) 17

248. A sound source of frequency 170 Hz is placed near a wall. A man walking from the source normally towards the wall finds that there is a periodic rise and fall of sound intensity. If speed of sound in air is 340 rn/s, the distance in metres separating the two adjacent positions of minimum intensity is:
a) (1/2) b) 1 c) (3/2) d) 2

249. Which of the following expressions is that of a simple harmonic progressive wave?
a) $A\sin\omega t$ b) $A\sin\omega t\cos kx$ c) $A\sin(\omega t - kx)$ d) $A\cos\ kx$

250. If two waves of same frequency and same amplitude respectively on superimposition produced a resultant disturbance of the same amplitude the wave differ in phase by :
a) π b) 2π/3 c) π/2 d) zero

251. $x_1 = A\sin(\omega t - 0.1x)$ and $x_2 = A\sin\left(\omega t - 0.1x - \frac{\phi}{2}\right)$, resultant amplitude of combined wave is:

a) $2A\cos\frac{\phi}{4}$ b) $A/\sqrt{2\cos\phi/2}$ c) $2A\cos\frac{\phi}{2}$ d) $A\sqrt{2\left(1+\cos\frac{\phi}{4}\right)}$

252. The SHM of a particle is given by: $X(t) = 5\cos\left(2\pi t + \frac{\pi}{4}\right)$ (in MKS units).Calculate the displacement and magnitude of acceleration of the particle at f = 1.5 seconds.
a) - 3.0m, 100m/s^2 b) +2.54m, 200m/s^2 c) - 3.54m, 140m/s^2 d) +3.55m, 120m/s^2

253. What is the effect on the time period of a simple pendulum if the mass of the bob is doubled?
a) Halved b) Doubled c) Becomes 8 times d) No effect

254. In which medium sound has maximum velocity
a) In gases b) In liquids c) In solids d) In vacuum

255. Two tuning forks when sounded together produced 4 beats/sec. The frequency of one fork is 256 Hz. The number of beats heard increases when the fork of frequency 256 Hz is loaded with wax. The frequency of the other fork is :
a) 504 Hz b) 520 Hz c) 260 Hz d) 252 Hz

256. A simple harmonic oscillator has an amplitude A and time period T.The time required by it to travel from x = A to x = A/2 is :
a) T/6 b) T/4 c) T/3 d) T/2

257. In the following question, a statement of assertion is followed by a statement of reason. Mark the correct choice as :
Assertion: In damped oscillations, the energy of the system is dissipated continuously.
Reason: For small damping, the oscillations remain approximately periodic.
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

258. The speed of sound through oxygen at T K is u ms^{-1}. As the temperature becomes 2T and oxygen gas dissociated into atomic oxygen, the speed of sound:
a) remains the same b) becomes 2u c) becomes $\sqrt{2}$v d) none of these

259. A string fixed at its both ends vibrates in 5 loops as shown in figure

The total number of nodes and anti nodes are respectively
a) 5,6 b) 6,5 c) 7,4 d) 4,7

260. Which of the following phenomenon is used by the musicians to tune their musical instruments?
a) Interference b) Diffraction c) Beats d) Polarisation

261. A 5 kg collar is attached to a spring of spring constant 500 N m^{-1}, It slides without friction over a horizontal rod. The collar is displaced from its equilibrium position by 10 cm and released. The time period of oscillation is:
a) $\frac{\pi}{5}s$ b) $\frac{\pi}{2}s$ c) πs d) 2π s

262. Plane simple harmonic progressive waves of wavelengths 120 cm and speed 34800 cm/sec are incident normally on a plane surface which is a perfect reflector of sound. Stationary waves are formed. The ratio of amplitudes of vibrations at points distant (i) 10 cm (ii) 30 cm from the reflector is:
a) 1:2 b) 1:0 c) 1:1 d) 1:4

263. A tuning fork when sounded together with a tuning fork of frequency 256 Hz emits two beats. On loading the tuning fork of frequency 256 Hz. the number of beats heard is one per second. The frequency of tuning fork is :
a) 257 Hz b) 258 Hz c) 256 Hz d) 254 Hz

264. A source and listener are both moving towards each other with speed v/10 where v is the speed of sound. If the frequency of the note emitted by the source is f, the frequency heard by the listener would be nearly:
a) 1.11 f b) 1.22 f c) f d) 1.27 f

265. For a particle executing SHM along x-axis, force acting onit , is given by:
a) -A k x b) A cos kx c) A exp (-k x) d) A k x

266. Assertion: The sound emitted by the source travels in all directions.
Reason: The relative velocity of sound with respect to the observer is the sum of velocity of sound and velocity of observer.
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.

267. Sound waves travel fastest in
a) solids b) liquids c) gases d) vacuum

268. A wave equation which gives the displacement along Y-direction is given: y = 10^4 sin (60t + 2x) . Where, x and y are in metre and t in sec. Among the following choose the correct statement.
a) It represents a wave propagating along positive x-axis with a velocity of 30 m/s.
b) It represents a wave propagating along negative x-axis with a velocity of 120 m/s.
c) It represents a wave propagating along negative x-axis with a velocity of 30 m/s.
d) It represents a wave propagating along negative x-axis with a velocity of 10^4 m/s.

269. Sound waves in air cannot be polarized because
a) their speed is small b) they require medium c) these are longitudinal
d) their speed is temperature dependent

270. Particle executing SHM is described by the displacement function x(t) = $A\cos(\omega t + \phi)$ If the initial (t = 0) position of the particle is πcms^{-1} , its initial velocity is 1t em S^{-1} and its angular frequency is π s^{-l}, then the amplitude of its motion is:
a) π cm b) 2 cm c) $\sqrt{2}$ cm d) 1 cm

271. A hospital uses an ultrasonic scanner to locate tumours in a tissue. The operating frequency of the scanner is 4.2 MHz. The speed of sound in a tissue is 1.7 km/s. The wavelength of sound in tissue is close to _____ .
a) 4×10^{-4} m b) 8×10^{-4} m c) 4×10^{-3} m d) 8×10^{-3} m

272. The period of simple harmonic oscillator is 24 see and the initial phase is zero. The time at which the oscillating point would have attained half the amplitude is
a) 2 sec b) 2.4 sec c) 6 sec d) 12 sec

273. Assertion : The fundamental frequency of an open organ pipe increases as the temperature is increased.
Reason: As the temperature increases the velocity of sound increases more rapidly than length of pipe.

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.

274. The equation of a progressive wave can be given by y = 15 sin (660πt - 0.02πx) cm. The frequency of the wave is:
a) 330 Hz b) 342 Hz c) 365 Hz d) 660 Hz

275. Which one of the following does not represent a travelling wave?
a) $y = y_m f(x - vt)$ b) $y = y_m \sin k(x - vt)$ c) $y = y_m \log(x - vt)$ d) $y = f(x^2 - vt^2)$

276. A transverse wave consists of
a) only crests b) only troughs c) both crests and troughs
d) rarefactions and compressions

277. The equation of progressive wave is $y = 2\sin\pi(0.5x + 200t)$(x, y in cm). The amplitude and velocity of wave respectively are:
a) 2π cm, 100 cm/sec b) $\frac{2\pi}{3} cm,$ 0.5 cm/sec c) 2 cm, 400 cm/sec d) 0.2 cm, 200 cm/sec

278. Two waves represented by: $y_1 = a\sin\frac{2\pi}{\lambda}(vt - x)$ and $y_2 = a\cos\frac{2\pi}{\lambda}(vt - x),$ are superposed. The resultant wave has an amplitude equal to:
a) zero b) 2a c) a d) $a\sqrt{2}$

279. Frequency of variation of kinetic energy of a simple harmonic motion of frequency n is
a) 2n b) n c) $\frac{n}{2}$ d) 3n

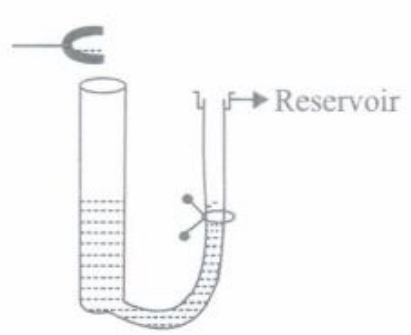
280. Velocity of sound in a medium is v. If the density of the medium is doubled, what will be the new velocity of sound?
a) $\sqrt{2}v$ b) v c) $v/\sqrt{2}$ d) $2v$

281. In case of a forced oscillation, the resonance peak becomes very sharp when the
a) restoring force is small. b) damping force is small. c) quality factor is small
d) applied periodic force is small.

282. A tuning fork A of frequency 512 Hz produces 5 beats per second when sounded with another tuning fork B of unknown frequency. If B is loaded with wax the number of beats is again 5per second. The frequency of the tuning fork B before it was loaded is
a) 502 Hz b) 507 Hz c) 517 Hz d) 522 Hz

283. A band playing music at a frequency u is movmg towards a wall at a speed v_b' A motorist is following the band with a speed v_m. If v is the speed of sound, It I the expression for the beat frequency heard by the motorist is
a) $\frac{v + v_m}{v + v_b} v$ b) $\frac{v + v_m}{v - v_b} v$ c) $\frac{2v_b(v + v_m)}{v^2 - v_b^2} v$ d) $\frac{2v_m(v + v_b)}{v^2 - v_m^2} v$

284. A tuning fork vibrating with a frequency of 500 Hz is kept close to the open end of a tube filled with water, as shown in figure. The water level in the tube is gradually lowered. When the water



level is 17 cm below the open end, maximum intensity of sound is heard. If the room temperature is 20°C, the speed of sound in air at this temperature is

a) 330 m s^{-1} b) 340 m s^{-1} c) 350 m s^{-1} d) 360 m s^{-1}

285. A string is hanging from a rigid support. A transverse pulse is excited at its free end. The speed at which the pulse travels a distance x is proportional to:

a) x b) $\frac{1}{x}$ c) $\frac{1}{\sqrt{x}}$ d) x^2 e) $\sqrt{x}$

286. The displacement of a particle is represented by the equation $y = sin^3\omega t$ The motion is

a) non-periodic b) periodic but not simple harmonic c) simple harmonic with period
d) simple harmonic with period

287. In the following question, a statement of assertion is followed by a statement of reason. Mark the correct choice as :

Assertion: An earthquake will not cause uniform damage to all building in an affected area, even if they are built with the same strength and materials.

Reason : The one with its natural frequency close to the frequency of seismic wave is likely to be damaged less.

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

288. Which one of the following statements is true?

a) The sound waves in air are longitudinal while the light waves are transverse
b) Both light and sound waves in air are longitudinal
c) Both light and sound waves can travel in vacuum
d) Both light and sound waves in air are hansverse

289. A sonometer wire 100 em long has a fundamental frequency of 330 Hz. The velocity of propagation of transverse waves on the wire is:

a) 330 ms^{-1} b) 660 ms^{-1} c) 900 ms^{-1} d) 115 ms^{-1}

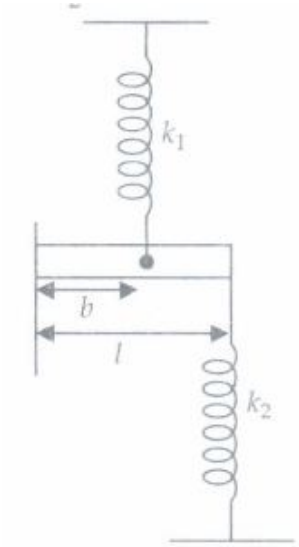
290. Match the Column I with Column II.

Column I		**Column II**	
(A)	Change in apparent frequency due to the relative motion between source and listener is	(p)	Beats
(B)	Intensity of sound varies with time in	(q)	Transverse wave
(C)	Sound waves in air are	(r)	Doppler's effect

(D)	Light waves are	(s)	Longitudinal wave

a) A - p, B - q, C - r, D - s b) A - q, B - r, C - s, D - P c) A - r, B - p, C - s, D - q
d) A - r, B - s, C - p, D - q

291. A rod of mass 11/ and length I is connected by two spring of spring constants k_l and "k_2' so that it is horizontal at equilibrium. What is the natural frequency of the system?



a) $\frac{1}{2\pi}\sqrt{\frac{k_1b^2+k_2l^2}{ml^2}}$ b) $\frac{1}{2\pi}\sqrt{\frac{2k_1b^2+k_2l^2}{ml^2}}$ c) $\frac{1}{2\pi}\sqrt{\frac{k_1b^2+k_2l^2}{2ml^2}}$ d) $\frac{1}{2\pi}\sqrt{\frac{3\left(k_1b^2+k_2l^2\right)}{ml^2}}$

292. A particle executing simple harmonic motion with an amplitude 5 cm and a time period 0.2 s. The velocity and acceleration of the particle when the displacement is 5 cm is:
a) 0.57πm s^{-1}, 0 m s^{-2} b) 0.5 m s^{-l}, $-57\pi^2$ m s^{-2} c) 0 m s^{-1} , $-57\pi^2$ m s^{-2}
d) 0.57πms^{-1}, $-0.57\pi^2$ms^{-2}

293. In the equation $y = 4\cos(2\pi x/50)\sin 100\pi t,$ y represents the displacement of a particle at the distance x from the origin and at the time t.Then, a node occurs at the following distance:
a) 12.5 cm b) 50 cm c) 20 cm d) $(100/2\pi)cm$

294. The noise level for the threshold of pain (intensity 10^0 watt/m ^{2}) is:
a) 12 dB b) 120 dB c) 10^6 dB d) 10 dB

295. The acceleration due to gravity on the surface of the moon is 1.7 m s^{-2} . The time period of a simple pendulum on the moon if its time period on the earth is 3.5 s is (Given,g= 9.8 m s^{-2}).
a) 2.2 s b) 4.4 s c) 8.4 s d) 16.8 s

296. A vibratory motion is represented by

$$x = 2A\cos\omega t + A\cos\left(\omega t + \frac{\pi}{2}\right) + A\cos(\omega t + \pi) + \frac{A}{2}\cos\left(\omega t + \frac{3\pi}{2}\right)$$

The resultant amplitude of the motion is

a) $\frac{9A}{2}$ b) $\frac{\sqrt{5}A}{2}$ c) $\frac{5A}{2}$ d) 2A

297. Which of the following statements is incorrect?
a) Sound travels in straight lines. b) Sound travels as waves.
c) Sound is a form of energy. d) Sound travels faster in vacuum than in air.

298. The equation of a progressive wave is given by y = 5 sin(100nt -0.4πππx) where y and x are in m and t is in s.
(1) The amplitude of the wave is 5 m.
(2) The wavelength of the wave is 5 m.
(3) The frequency of the wave is 50 Hz.
(4) The velocity of the wave is 250 m S^{-1}.
Which of the following statements are correct?
a) (1), (2) and (3) b) (2) and (3) c) (1) and (4) d) All are correct

299. An air chamber of volu ne V has a neck of crosssectional area a into w' ICh a light ball of mass m just fits and can move up ind down without friction. The diameter of the ball is equal to that of the neck of the chamber. The ball is pressed down a little and released. If the bulk modulus of air is B, the time period of the oscillation of the ball is
a) $T = 2\pi\sqrt{\frac{Ba^2}{mV}}$ b) $T = 2\pi\sqrt{\frac{BV}{ma^2}}$ c) $T = 2\pi\sqrt{\frac{mB}{Va^2}}$ d) $T = 2\pi\sqrt{\frac{mV}{Ba^2}}$

300. Mark the correct statement.
a) In case of stationary waves maximum pressure change occurs at antinode.
b) Velocity of longitudinal waves in a medium is its physical characteristic.
c)
Due to propagation of longitudinal wave in air, maximum pressure change is equal to $2\pi na/\rho\upsilon$
d) None of the above

301. If C_o and C denote the sound velocity and root mean square velocity of molecules in a gas, then:
a) $C_0 = C$ b) $C_0 = C\left(\frac{\gamma}{3}\right)^{1/2}$ c) C_0 and C are not related d) $C_0 > C$

302. The time period of a simple pendulum is 2s. If its length is increased by 4 times, then its period becomes _____ .
a) 16 s b) 12 s c) 8 s d) 4 s

303. If v_{rms} is the rms speed of molecules in a gas and v is the speed of sound waves in the gas, then the ratio $\frac{v_{rms}}{v}$
a) $\sqrt{\frac{3}{\gamma}}$ b) $\sqrt{\frac{\gamma}{3}}$ c) $\sqrt{3\gamma}$ d) $\frac{\sqrt{3}}{\gamma}$

304. The two nearest harmonics of a tube closed at one end and open at other end are 220 Hz and 260 Hz. What is the fundamental frequency of the system?
a) 20 Hz b) 30 Hz c) 40 Hz d) 10 Hz

305. The electric field of an electromagnetic wave in free space is given by
$\vec{E} = 10\cos\left(10^7 t + kx\right)\hat{j}V/m,$ where t and x are in seconds and metres respectively. It can be inferred that:
(1) the wavelength λ is 188.4 m
(2) the wave number k is 0.33 rad/m

(3) the wave amplitude is 10 V/m

(4) the wave is propagating along + X-direction

Which one of the following pairs of statements is correct?

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

306. When sound waves travel from air to water which of these remains constant?

a) Velocity b) Freqaency c) Wavelength d) All of these

307. When two sound waves are superimposed, beats are produced when they have

a) Different amplitudes and phases b) Different velocities c) Different phases

d) Different frequencies

308. Two particles execute SHM of same amplitude and frequency on parallel lines. They pass one another when moving in opposite directions each time when their displacement is half of the amplitude. The phase difference between them is

a) 0 b) $\frac{2\pi}{3}$ c) π d) $\frac{\pi}{6}$

309. At a certain instant, a stationary transverse wave is found to have maximum kinetic energy. The appearance of string at that instant is:

a) sinusoidal shape with amplitude A/3 b) sinusoidal shape with amplitude A/2

c) sinusoidal shape with amplitude A d) straight line

310. Two identical sinusoidal waves each of amplitude 10 mm with a phase difference of 90° are travelling in the same direction in a string. The amplitude of the resultant wave is

a) 5 mm b) $10\sqrt{2}$ mm c) 15 mm d) 20 mm

311. A mass m is suspended from the two coupled springs connected in series. The force constant for springs are k_1 and k_2. The time period of the suspended mass will be:

a) $T = 2\pi\sqrt{\frac{m}{k_1 - k_2}}$ b) $T = 2\pi\sqrt{\frac{mk_1k_2}{k_1 + k_2}}$ c) $T = 2\pi\sqrt{\frac{m}{k_1 + k_2}}$ d) $T = 2\pi\sqrt{\frac{m\left(k_1 + k_2\right)}{k_1k_2}}$

312. A closed organ pipe and an open organ pipe of same length produce 2 beats/second while vibrating in their fundamental modes. The length of the open organ pipe is halved and that of closed pipe is doubled. Then, the number of beats produced per second while vibrating in the fundamental mode is

a) 2 b) 6 c) 8 d) 7

313. Time period of oscillation of a spring is 12 s one arth. What shall be the time period if it is taken to moon?

a) 6 s b) 12 s c) 36 s d) 72 s

314. A 10m long steel wire has mass 5 g. If the wire is under a tension of 80 N, the speed of transverse waves on the wire is

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

315. A stretched string resonates with tuning fork of frequency 512 Hz when length of the string is 0.5 m. The length of the string required to vibrate resonantly with a tuning fork of frequency 256 Hz would be:

a) 0.25 m b) 0.5 m c) 1 m d) 2 m

316. In the following question, a statement of assertion is followed by a statement of reason. Mark the correct choice as :
Assertion: The skill in swinging to greater heights lies in the synchronisation of the rhythm of pushing against the ground with the natural frequency of the swing.
Reason: The phenomenon behind this is resonance
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

317. A particle moves such that its acceleration a is given by a = - bx, where x is the displacement from equilibrium position and b is a constant. The period of oscillation is:
a) $2\pi\sqrt{b}$ b) $2\pi/\sqrt{b}$ c) 2π/b d) $2\sqrt{\pi/b}$

318. When stationary waves are set up, pick out the correct statement from the following.
a)
All the particles in the medium are in the same phase of vibration at all times and distances
b)
The particles with an interval between two consecutive nodes are in phase, but the particles in two such consecutive intervals are of opposite phase
c)
The phase lag along the path of the wave increases as the distance from the source increases
d) Only antinodes are in same phase

319. When a wave travels in a medium the particles displacement is given by the equation; $y = 0.03\sin\pi(2t - 0.01x),$ where x and y are in metre and t in second. The wavelength of the wave is:
a) 200 m b) 100 m c) 20 m d) 10 m

320. The transverse wave represented by the equation
$y = 4\sin\frac{\pi}{6}\sin(3x - 15t)$ has:
a) amplitude =4p b) wavelength $= \frac{4\pi}{3}$ c) speed of propagation =5 d) period $= \frac{\pi}{15}$

321. Two tuning forks are in vibration and no beats are heard. One of the prongs of one tuning fork is loaded and then it is sounded with another tuning fork and four beats are heard. Now, the prongs of loaded tuning fork are cut slightly. Now, on sounding together they produce 4 beats. Initially, the ratio of the frequencies of the two tuning forks was:
a) 1:1 b) 4:1 c) 1:4 d) 1:2

322. On sounding tuning fork A with another tuning fork B of frequency 384 Hz, 6 beats are produced per second. After loading the prongs of A with some wax and then sounding it again with B, 4 beats are produced per second. What is the frequency of the tuning fork A?
a) 388 Hz b) 378 Hz c) 380 Hz d) 390 Hz

323. A particle starts simple harmonic motion from the mean position. Its amplitude is a and time period is T. What is its displacement when its speed is half of its maximum speed?

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

324. Two open organs pipes of fundamental frequencies u_1 and u_2 are joined in series. The fundamental frequency of the new pipe so obtained will be

a) v_1+v_2 b) $\frac{v_1v_2}{(v_1+v_2)}$ c) $\frac{v_1v_2}{v_1-v_2}$ d) $\sqrt{(v_1^2+v_2^2)}$

325. The speed of sound in hydrogen at NTP is 1270 m/s. Then, the speed in a mixture of hydrogen and oxygen in the ratio 4: 1 by volume will be:

a) 317 m/s b) 635 m/s c) 830 m/s d) 950 m/s

326. Two vibrating tuning forks producing progressive waves given by:

$y_1 = 4\sin(500\pi t)$ and $y_2 = 2\sin(506\pi t)$ are held near the ear of a person. The person will hear:

a) 3 beats per second with intensity ratio between maxima and minima equal to 9

b) 3 beats per second with intensity ratio between maxima and minima equal to 2

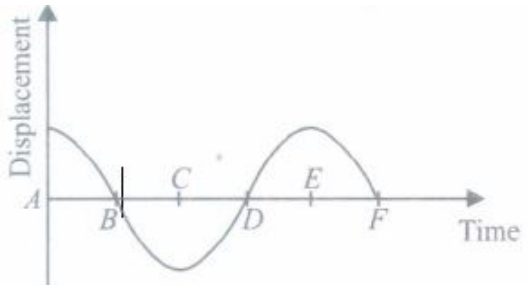
c) 6 beats per second with intensity ratio between maxima and minima equal to 2

d) 6 beats per second with intensity ratio between maxima and minima equal to 9

327. A line source emits a cylindrical wave. If the medium absorbs no energy, the amplitude will vary with distance r from the source as proportional to:

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

328. Displacement versus time curve for a particle executing SHM is as shown in figure.



At what points the velocity of the particle is zero?

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

329. With propagation of longitudinal waves through a medium, the quantity transmitted is

a) matter b) energy c) energy and matter d) energy, matter and momentum

330. The total energy of a simple harmonic oscillator is proportional to

a) amplitude b) square of amplitude c) frequency d) velocity

331. A pendulum has a string of length 99.39 cm. How much length of the pendulum must be shortened to keep the current time of the pendulum if it loses 4 s a day?

a) 0.0009 cm b) 0.009 cm c) 0.09 cm d) 0.9 cm

332. A wave equation is: $y= 10^{-4} \sin (60t + 2x)$, where, x and y are in metres and t is in sec. Which of the following statements is correct?

a) The wave travels with a velocity of 300 m/s in the negative direction of the x-axis

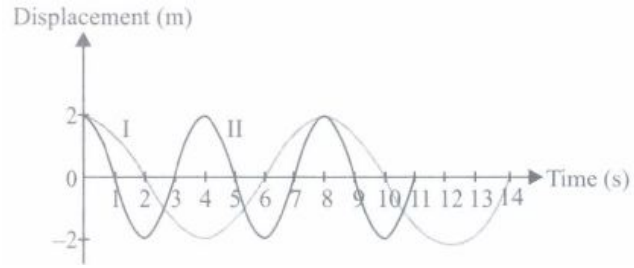
b) Its wavelength is π metre c) Its frequency is 50π hertz d) All of the above

333. Two harmonic waves having same ω and k are travelling on a stretched string in the positive direction of X-axis. The waves have same amplitude but differ in their initial phase. The net displacement of the wave is given by :

a) $y(x, t) = 2a\sin\left(kx - \omega t + \frac{\phi}{2}\right)$ b) $y(x, t) = 2a\cos\frac{\phi}{2}\sin\left(kx - \omega t + \frac{\phi}{2}\right)$ c) $y(x, t) = a\sin\left(kx - \omega t + \frac{\phi}{2}\right)$

d) $y(x, t) = 2a\sin\frac{\phi}{2}\sin\left(kx - \omega t + \frac{\phi}{2}\right)$

334. Figure shows the displacement-time graphs of two simple harmonic motions I and II. From the graph it follows that



a) curve I has same frequency as that of curve II

b) curve I has frequency twice that of curve II. c) curve I has frequency half that of curve II.

d) curve I has frequency four times that of curve II.

335. The Doppler effect is applicable for

a) sound waves only b) light waves only c) both sound and light waves

d) none of these

336. The phase difference between oscillatory motion of two points separated by a distance of $\frac{\lambda}{2}$ is (where λ is the wavelength)

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

337. If the frequency of human heart is 1.25 Hz, the number of heart beats in 1minute is

a) 65 b) 75 c) 80 d) 90

338. Velocity of sound waves in air is 3.30 m/s. For a particular sound wave in air, path difference of 40 cm is equivalent to phase difference of 1.6p. The frequency of this wave is _____ .

a) 165 Hz b) 150 Hz c) 660 Hz d) 330 Hz

339. If two tuning forks A and B are sounded together, they produce 4 beats per second. A is then slightly loaded with wax, they produce beats when sounded again. The frequency of A is 256 Hz. The frequency of B will be:

a) 250 Hz b) 252 Hz c) 260 Hz d) 262 Hz

340. The phase difference between two waves, represented by:

$y_1 = 10^{-6}\sin[100t + (x/50) + 0.5]m$ $y_2 = 10^{-6}\cos[100t + (x/50)]m$. where x is expressed in metres and t is expressed in seconds, is approximately:

a) 1.07 rad b) 2.07 rad c) 0.5 rad d) 1.5 rad

341. The frequency of sinusoidal wave, 0.40 cos (2000t + 0.80) would be:

a) 1000p Hz b) 2000 Hz c) 20 Hz d) $\frac{1000}{\pi}$Hz

342. A jet plane travels at Mach 2 at an altitude of 1600 m. How far past an observer will the plane be when the shock wave hits him?

a) 3200 m b) 3577 m c) 1600 m d) 2400 m

343. Beats are produced by two waves: $y_1 = a\sin 1000\pi t$ and $y_2 = a\sin 998\pi t$. The number of beats heard/sec is:
a) 1 b) 4 c) 0 d) 2

344. In the case of stationary waves all the particles of the medium between two nodes vibrate:
a) in phase but with different amplitudes and time periods
b) in phase and with same amplitude and time period
c) in phase with the same time period but different amplitudes
d) with the same time period but in different phases and with different amplitudes

345. If two sound waves: $y_1 = 0.3\sin 595\pi\left(t - \frac{x}{330}\right)$ and $y_2 = 0.5\sin 604\pi\left(t - \frac{x}{330}\right)$ are superposed. What will be (i) the frequency of the resultant wave (ii) the frequency at which the amplitude of resultant wave varies?
a) 600, 8 b) 300, 2 c) 300, 4 d) 600, 4

346. The stationary wave produced on a string is represented by the equation:
$y = 5\cos\left(\frac{\pi x}{3}\right)\sin 40\pi t,$ where x and yare in em and t is in seconds. The distance between two consecutive nodes is:
a) 5 cm b) 3 cm c) π cm d) 40 cm

347. When a wave propagates through the medium, the constituents of the medium gets disturbed. The speed of the waves is:
a) directly proportional to restoring force set up in the medium when it is disturbed
b) inversely proportional to the mass density of the medium
c)
directly proportional to the product of the restoring force and the mass density of the medium
d) both (a) and (b)

348. Two waves of wavelength 50 m and 51 cm produce 12 beat/s. The speed of sound is _____ .
a) 306 m/s b) 331 m/s c) 340 m/s d) 360 m/s

349. Two cars moving in opposite directions approach each other with speed of 22 m/s and 16.5 m/s respectively. The driver of the first car blows a horn having a frequency 400 Hz. The frequency heard by the driver of the second car is [velocity of sound 340m/s]
a) 361 Hz b) 411 Hz c) 448 Hz d) 350 Hz

350. Equations of motion in the same direction are given by:
$y_1 = 2a\sin(\omega t - kx)$ and $y_2 = 2a\sin(\omega t - kx - \theta)$. The amplitude of the medium particle will be:
a) $2a\cos\theta$ b) $\sqrt{2}a\cos\theta$ c) $4a\cos\theta/2$ d) $\sqrt{2}a\cos\theta/2$

351. A simple harmonic motion having an amplitude A and time period T is represented by the equation:
y = 5sin π (t+4)m

Then, the values of A (in m) and T (in see) are
A=5;T=2
a) A = 5; T = 2 b) A = 10; T = 1 c) A = 5; T=1 d) A = 10; T = 2

352. In a plane progressive harmonic wave particle speed is always less than the wave speed if:
a) amplitude of wave b) amplitude of wave c) amplitude of wave
d) amplitude of wave $> \lambda/\pi$

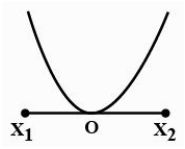
353. A wave travelling along the x-axis is described by the equation y (x, t) = 0.005 sin (αx - βt). If the wavelength and time period of the wave are 0.08 m and 2 s respectively, then α, β in appropriate units are
a) α = 25π , β = π b) $\alpha = \frac{0.08}{\pi}, \beta = \frac{2}{\pi}$ c) $\alpha = \frac{0.04}{\pi}, \beta = \frac{1}{\pi}$ d) $\alpha = 12.5, \beta = \frac{\pi}{2}$

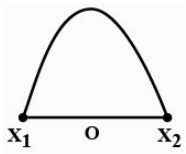
354. A bat emits ultrasonic sound of frequency 100 kHz in air. If this sound meets a water surface, the wavelengths of the reflected and transmitted sound are (speed of sound in air = 340ms^{-1} and in water = 1500ms^{-1}) :
a) 3.4 mm, 30 mm b) 6.8 mm, 15 mm c) 3.4 mm, 15 mm d) 6.8 mm, 30 mm

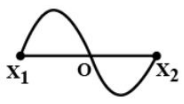
355. The transverse displacement of a string clamped at its both ends is given by y(x, t) = 0.06 sin $\left(\frac{2\pi}{3}x\right)$cos(120$\pi$t) where x and y are in m and tin s. The length of the string is 1.5 m and its mass is 3 x 10^{-2} kg. The tension in the string is
a) 324 N b) 648 N c) 832 N d) 972 N

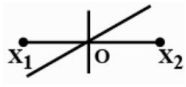
356. Ultrasonic waves produced by a vibrating quartz crystal are
a) only longitudinal b) only transverse c) both longitudinal and transverse
d) neither longitudinal nor transverse

357. In a sinusoidal wave, the time required for a particular point, to move from maximum displacement to zero displacement is 0.170 s. The frequency of the wave is _____ .
a) 1.47 Hz b) 0.36 Hz c) 0.73 Hz d) 2.94 Hz

358. A particle of mass m oscillates with simple harmonic motion between points x_1 and x_2, the equilibrium position being O. Its potential energy is plotted. It will be as given below in the graph.
a) 

b) 

c) 

d) 

359. A toothed wheel is rotating at 120 rpm and a postcard is placed against the teeth. How many teeth must it have to produce a note whose pitch is same as that of a tuning fork of frequency 256 per second?
a) 120 b) 128 c) 256 d) 256 x 120

360. The fundamental frequency of a closed organ pipe of length 20 cm is equal to the second overtone of an organ pipe open at both the ends. The length of organ pipe open at both the ends is :
a) 80 cm b) 100 cm c) 120 cm d) 140 cm

361. In the following question, a statement of assertion is followed by a statement of reason. Mark the correct choice as :
Assertion: Every periodic motion is not simple harmonic motion.
Reason : The motion governed by the force law F = -kx is simple harmonic.
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

362. A wave is represented by the equation: $y = 0.1\sin(100\pi t - kx)$. If wave velocity is 100 m/s, its wave number is equal to:
a) 1 m^{-1} b) 2 m^{-1} c) πm^{-1} d) $2\pi m^{-1}$

363. A heavy rope is suspended from a rigid sur-port. A wave pulse is set up at the lower end; then:
a) the pulse will travel with uniform speed b) the pulse will travel with increasing speed
c) the pulse will travel with decreasing speed d) the pulse cannot travel through the rope

364. Spring of force constant k is cut into lengths of ratio 1 : 2 : 3. They are connected in series and the new force constant is k', Then they are connected in parallel and force constant is k". then k' : k" is:
a) 1:9 b) 1:11 c) 1:14 d) 1:6

365. Two sound waves of slightly different frequencies propagating in the same direction produce beats due to:
a) interference b) diffraction c) reflection d) refraction

366. Two waves produce displacements at a point given by: $y_1 = a\sin\omega t$ and $y_2 = a\sin\left(\omega t + \frac{\pi}{2}\right)$.
The resultant amplitude is:
a) 0 b) 2a c) $\sqrt{2}a$ d) $a/\sqrt{2}$

367. Assertion: A wave is motion of matter as a whole in a medium.
Reason: Wind is same as sound wave in air
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.

368. The displacement x (in metres) of a particle performing simple harmonic motion is related to time t sec as x = 0.05 cos (4πt+π/4). The frequency of the motion will be:
a) 0.5 Hz b) 1.0 Hz c) 1.5 Hz d) 2.0 Hz

369. A block whose mass is 1kg is fastened to a spring. The spring has a spring constant of 100 Nm^{-1} The block is pulled to a distance x = 10 ern from its equilibrium position at x = 0 on a frictionless surface from rest at t = O. The kinetic energy and potential energy of the block when it is 5 em away from the mean position is
a) 0.0375 J, 0.125 J b) 0.125 J, 0.375 J c) 0.125 J, 0.125 J d) 0.375 J, 0.375 J

370. A note has a frequency 128 Hz. The frequency of a note two octaves higher than it is:
a) 256 Hz b) 64 Hz c) 32 Hz d) 384 Hz

371. At a point, beats frequency of n Hz is observed. It means:
a) medium particles, at that point, are vibrating with frequency n Hz
b) amplitude of vibrations changes simple harmonically with frequency n Hz at that point only
c) at that point, zero intensity is observed 2n times per second d) none of the above

372. Two waves of same frequency and intensity superimpose on each other in opposite phases. After the superposition, the intensity and frequency of waves will _____ .
a) Increase b) Decrease c) Remain constant d) Become zero

373. What is the effect of humidity on sound waves when humidity increases?
a) Speed of sound waves increases b) Speed of sound waves decreases
c) Speed of sound waves remains same d) Speed of sound waves becomes zero

374. A simple harmonic progressive wave is represented by the equation: y=8sin2π(0.1x−2t) Where, x and yare in em and t is in seconds. At any instant the phase difference between two particles separated by 2.0 em in the X -direction is:
a) 18° b) 54° c) 36° d) 72°

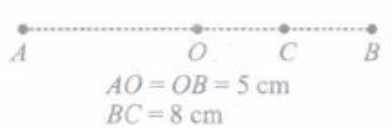
375. Equation of a plane progressive wave is given by $y = 0.6sin2\pi\left(t - \frac{x}{2}\right)$ On reflection from a denser medium its amplitude becomes $\frac{2}{3}$ of the amplitude of the incident wave. The equation of the reflected wave is

a) $y = 0.6sin2\pi\left(1 + \frac{x}{2}\right)$ b) $y = -0.4sin2\pi\left(t + \frac{x}{2}\right)$ c) $y = 0.4sin2\pi\left(t + \frac{x}{2}\right)$ d) $y = -0.4sin2\pi\left(t - \frac{x}{2}\right)$

376. Sound waves travel at 350 m/s through a warm air and at 3500 m/s through brass. The wavelength of a 700 Hz acoustic wave as it enters brass from warm air _____ .
a) Decreases by a factor 10 b) Increases by a factor 20 c) Increases by a factor 10
d) Decreases by a factor 20

377. A wave travels in a medium according to the equation of displacement given by :
$y(x, t) = 0.03\sin\pi(2t - 0.01x)$where y and x are in metre and t in second. The wavelength of the wave is:
a) 200 m b) 100 m c) 20 m d) 10 m

378. particle is in linear simple harmonic motion between two points A and B 10 crn apart (figure). Take the direction from A to B as the +ve direction. Which of the following statements is correct?



a) The sign of acceleration and force on the particle when it is at A is negative
b) The sign of acceleration and force on the particle when it is at B is positive

c)

The sign of velocity, acceleration and force on the particle when it is 3 cm away from A going towards B are positive.

d)

The sign of velocity, acceleration and force on the particle when it is 4 cm away from B going towards A are positive.

379. When two sound sources of the same amplitude but of slightly different frequencies v1 and v2 are sounded simultaneously, the sound one hears has a frequency equal to

a) $|v_1-v_2|$ b) $\left[\frac{v_1+v_2}{2}\right]$ c) $\sqrt{v_1 v_2}$ d) $\left[v_1+v_2\right]$

380. A hollow sphere is filled with water. It is hung by a long thread. As the water flows out of a hole at the bottom, the period of oscillation will:

a) first increase and then decrease b) first decrease and then increase

c) increase continuously d) decrease continuously

381. Which of the following equation represents a wave?

a) $y = a\sin\omega t$ b) $y = a\cos kx$ c) $y = a\sin(\omega t - bx + c)$ d) $y = a\sin(\omega t - kx)$

382. Which one of the following is not a periodic motion?

a) Rotation of the earth about its axis.

b) A freely suspended bar magnet displaced from its N-S direction and released

c) Motion of hands of a clock d) An arrow released from a bow.

383. A plane sound wave is travelling in a medium. With reference to a frame A, its equation is $y = a\cos(\omega t - kx)$. With reference to a frame B, moving with a constant velocity v in the direction of propagation of the wave, equation of the wave will be:

a) $y = a\cos[(\omega + kv)t - kx]$ b) $y = -a\cos[(\omega - kv)t - kx]$ c) $y = a\cos[(\omega - kv)t - kx]$

d) $y = a\cos[(\omega + kv)t + kx]$

384. Three sound waves of equal amplitudes have frequencies (n-1), n, (n+1). They superimpose to give beats. The number of beats produced per second will be:

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

385. A hospital uses an ultrasonic scanner to locate tumours in a tissue. The operating frequency of the scanner is 3.2 MHz. The speed of sound in a tissue is 1.6 km S^{-1}. The wavelength of sound in the tissue is

a) 0.25 mm b) 0.5 mm c) 0.75 mm d) 1mm

386. A wave is propagating along x-axis and another wave is propagating along y-axis. If they superimpose each other, the resultant wave will be:

a) circular b) parabolic c) straight line d) elliptical

387. To show that a simple pendulum executing a simple harmonic motion it is necessary to assume that

a) length of the pendulum is small. b) mass of the pendulum is small

c) acceleration due to gravity is small. d) amplitude of the oscillation is small

388. The speed of a wave in a certain medium is 960 m/sec. If 3600 waves pass over a certain point of the medium in 1 minute, the wavelength is :

a) 2 meters b) 4 meters c) 8 meters d) 16 meters

389. A cylindrical resonance tube open at both ends, has a fundamental frequency f, in air. If half of the length is dipped vertically in water, the fundamental frequency of the air column will be _____ .

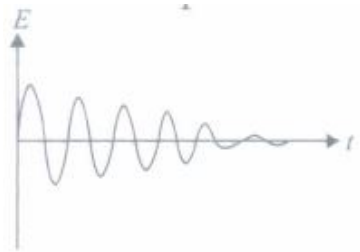
a) 2f b) $\frac{3f}{2}$ c) f d) $\frac{f}{2}$

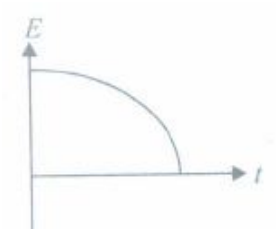
390. Waves of displacement amplitude A and angular frequency ω travel in air with the same velocity. Which of the following waves has the highest intensity?

a) A = 10×10^{-4} m, ω= 500 s^{-1} b) A = 2×10^{-4} m, ω= 2000 s^{-1} c) A = 2×10^{-4} m, ω= 115 s^{-1}

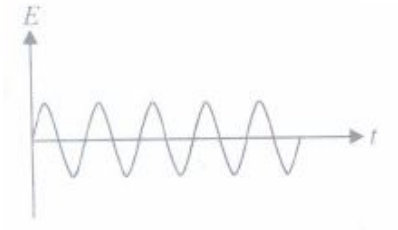
d) A = 20×10^{-4} m, ω= 200 s^{-1}

391. Which of the following energy-time graphs represents damped harmonic oscillator?

a) 

b) 

c) 

d) 

392. A vehicle, with a horn of frequency n is moving with a velocity of 30 m/s in a direction perpendicular to the straight line joining the observer and the vehicle. The observer perceives the sound to have a frequency n + n_1. Then (If the sound velocity in air is 300 m/s)

a) $n_1 = 10n$ b) $n_1 = 0$ c) $n_1 = 0.1n$ d) $n_1 = -0.1n$

393. Assertion: Intensity of sound wave does not change when the listener moves towards or away from stationary source.

Reason: The motion of listener causes the apparent change in wavelength.

a)

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

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

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

394. A source and an observer move away from each other, with a velocity of 10 m /s with respect to ground. If the observer finds the frequency of sound coming from the source as 1950 Hz, then original frequency of source is (velocity of sound in air =340 m/s)

a) 1950 Hz b) 1838.5 Hz c) 2132 Hz d) 2486 Hz

395. Two Simple Harmonic Motions of angular frequency 100 and 1000 rad s^{-1} have the same displacement amplitude. The ratio of their maximum accelerations is ::

a) $1:10^4$ b) 1:10 c) $1:10^2$ d) $1:10^3$

396. Two tuning forks have frequencies 380 and 384 hertz respectively. When they are sounded together, they produce 4 beats. After hearing the maximum sound, how long will it take to hear the minimum sound

a) 1/2 sec b) 1/4 sec c) 1/8 sec d) 1/16 sec

397. Match the Column I with Column II

Column I		**Column II**	
(A)		(p)	$T = 2\pi\sqrt{\frac{m(k_1+k_2)}{k_1k_2}}$
(B)		(q)	$T = 2\pi\sqrt{\frac{2m}{k}}$
(C)		(r)	$T = 2\pi\sqrt{\frac{m}{2k}}$
(D)		(s)	$T = 2\pi\sqrt{\frac{m}{k_1+k_2}}$

a) A - p, B - q, C - s, D - r b) A - s, B - r, C - p, D - q c) A - r, B - p, C - s, D - q
d) A - p, B - r, C - q, D - s

398. In the following question, a statement of assertion is followed by a statement of reason. Mark the correct choice as :
Assertion: The motion of the earth around the sun is periodic but not oscillatory.
Reason: Oscillatory motion is necessarily periodic but periodic motion is not necessarily oscillatory.
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

399. When a string fixed at its both ends vibrates in 1 loop, 2 loops, 3 loops and 4 loops, the frequencies are in the ratio
a) 1: 1 : 1 : 1 b) 1: 2 : 3 : 4 c) 4: 3 : 2 : 1 d) 1 : 4 : 9 : 16

400. A particle is executing a simple of harmonic motion amplitude a. Its potential energy is maximum when the displacement from the position of the maximum kinetic energy is:
a) 0 b) +a c) $\pm a/2$ d) $-a/2$