3. Ultrasonic, Infrasonic and audible waves travel through a medium with speeds V_u, V_i and V_a respectively, then

[CPMT 1989]

(a) V_u, V_i and V_a are nearly equal

(b) $V_u \geq V_a \geq V_i$

(c) $V_u \leq V_a \leq V_i$

(d) $V_a \leq V_u$ and $V_u \approx V_i$

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

[CPMT 1990]

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

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

5. A tuning fork makes 256 vibrations per second in air. When the velocity of sound is 330 *m/s*, then wavelength of the tone emitted is

[KCET 1994; AFMC 1998; MH CET 1999; CBSE PMT 1999]

(a) 0.56 *m* (b) 0.89 *m*

(c) 1.11 *m* (d) 1.29 *m*

6. A man sets his watch by a whistle that is 2 *km* away. How much will his watch be in error. (speed of sound in air 330 *m/sec*)

[MP PET 1991]

(a) 3 seconds fast (b) 3 seconds slow

(c) 6 seconds fast (d) 6 seconds slow

7. When a sound wave of frequency 300 *Hz* passes through a medium the maximum displacement of a particle of the medium is 0.1 *cm*. The maximum velocity of the particle is equal to **[MNR 1992; UPSEAT 1998, 2000; RPMT 2002; Pb. PET 2004]**

(a) 60 π *cm/sec* (b) 30 π *cm/sec*

(c) 30 *cm/sec* (d) 60 *cm/sec*

8. Sound waves have the following frequencies that are audible to human beings

[CPMT 1975]

(a) 5 *c/s* (b) 27000 *c/s*

(c) 5000 *c/s* (d) 50,000 *c/s*

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

[CBSE PMT 1990]

(a) 165 *Hz* (b) 150 *Hz*

(c) 660 *Hz* (d) 330 *Hz*

10. The wavelength of ultrasonic waves in air is of the order of

[EAMCET 1989]

(a) 5×10^{-5} *cm* (b) 5×10^{-8} *cm*

(c) 5×10^{5} *cm* (d) 5×10^{8} *cm*

11. The relation between phase difference ($\Delta\phi$) and path difference (Δx) is **[MNR 1995; UPSEAT 1999, 2000]**

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

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

12. 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 $km\text{-}s^{-1}$. The wavelength of sound in the tissue is close to

[CBSE PMT 1995]

(a) 4×10^{-4} *m* (b) 8×10^{-3} *m*

(c) 4×10^{-3} *m* (d) 8×10^{-4} *m*

13. The minimum audible wavelength at room temperature is about **[AFMC 1996]**

(a) 0.2 *Å* (b) 5 *Å*

(c) 5 *cm* to 2 *metre* (d) 20 *mm*

14. The ratio of the speed of sound in nitrogen gas to that in helium gas, at 300 *K* is

[IIT 1999]

(a) $\sqrt{2/7}$ (b) $\sqrt{1/7}$

(c) $\sqrt{3}/5$ (d) $\sqrt{6}/5$

15. In a sinusoidal wave, the time required for a particular point to move from maximum displacement to zero displacement is 0.170 second. The frequency of the wave is

[CBSE PMT 1998; AIIMS 2001; AFMC 2002; CPMT 2004]

(a) 1.47 *Hz* (b) 0.36 *Hz*

(c) 0.73 *Hz* (d) 2.94 *Hz*

16. The number of waves contained in unit length of the medium is called **[AIIMS 1998]**

(a) Elastic wave (b) Wave number

(c) Wave pulse (d) Electromagnetic wave

17. The frequency of a rod is 200 *Hz*. If the velocity of sound in air is $340\,ms^{-1}$, the wavelength of the sound produced is

[EAMCET (Med.) 1995; Pb. PMT 1999; CPMT 2000]

(a) 1.7 *cm* (b) 6.8 *cm*

(c) 1.7 *m* (d) 6.8 *m*

18. Frequency range of the audible sounds is

[EAMCET (Med.) 1995; RPMT 1997]

(a) 0 *Hz* – 30 *Hz* (b) 20 *Hz* – 20 *kHz*

(c) 20 *kHz* – 20,000 *kHz* (d) 20 *kHz* – 20 *MHz*

19. In a medium sound travels 2 *km* in 3 *sec* and in air, it travels 3 *km* in 10 *sec*. The ratio of the wavelengths of sound in the two media is

[NTSE 1995]

(a) 1 : 8 (b) 1 : 18

(c) 8 : 1 (d) 20 : 9

20. A stone is dropped into a lake from a tower 500 *metre* high. The sound of the splash will be heard by the man approximately after **[CPMT 1992; JIPMER 2001, 02; Kerala PMT 2005]**

(a) 11.5 seconds (b) 21 seconds

(c) 10 seconds (d) 14 seconds

21. When sound waves travel from air to water, which of the following remains constant

[AFMC 1993; DCE 1999; CPMT 2004]

(a) Velocity (b) Frequency

(c) Wavelength (d) All the above

22. A stone is dropped in a well which is 19.6*m* deep. Echo sound is heard after 2.06 *sec* (after dropping) then the velocity of sound is

[RPMT 1999]

(a) 332.6 *m*/*sec* (b) 326.7 *m*/*sec*

(c) 300.4 *m*/*sec* (d) 290.5 *m*/*sec*

23. At what temperature velocity of sound is double than that of at 0°*C*

[RPMT 1999]

(a) 819 *K* (b) 819°*C*

(c) 600°*C* (d) 600 *K*

24. Velocity of sound is maximum in

[AFMC 1998; BCECE 2001; RPMT 1999, 02]

(a) Air (b) Water

(c) Vacuum (d) Steel

25. If velocity of sound in a gas is 360 *m*/*s* and the distance between a compression and the nearest rarefaction is 1*m*, then the frequency of sound is **[KCET 1999]**

(a) 90 *Hz* (b) 180 *Hz*

(c) 360 *Hz* (d) 720 *Hz*

26. If the density of oxygen is 16 times that of hydrogen, what will be the ratio of their corresponding velocities of sound waves **[KCET 1999]**

(a) 1 : 4 (b) 4 : 1

(c) 16 : 1 (d) 1 : 16

27. At which temperature the speed of sound in hydrogen will be same as that of speed of sound in oxygen at 100°*C*

[UPSEAT 1999]

(a) – 148°*C* (b) – 212.5°*C*

(c) – 317.5°*C* (d) – 249.7°*C*

28. A tuning fork produces waves in a medium. If the temperature of the medium changes, then which of the following will change **[EAMCET (Med.) 1998; Pb. PMT 1999; MH CET 2001]**

(a) Amplitude (b) Frequency

(c) Wavelength (d) Time-period

29. The wave length of light in visible part (λ_V) and for sound (λ_S) are related as

(a) $\lambda_V > \lambda_S$ (b) $\lambda_S > \lambda_V$

(c) $\lambda_S = \lambda_V$ (d) None of these

30. Which of the following is different from others

[AFMC 1994; CPMT 1999; Pb. PMT 2004]

(a) Velocity (b) Wavelength

(c) Frequency (d) Amplitude

31. The phase difference between two points separated by 1m in a wave of frequency 120 *Hz* is 90^o. The wave velocity is

[KCET 1999]

(a) 180 *m/s* (b) 240 *m/s*

(c) 480 *m/s* (d) 720 *m/s*

32. The echo of a gun shot is heard 8 sec. after the gun is fired. How far from him is the surface that reflects the sound (velocity of sound in air = 350 *m/s*) **[JIPMER 1999]**

(a) 1400 *m* (b) 2800 *m*
(c) 700 *m* (d) 350 *m*

33. A man sets his watch by the sound of a siren placed at a distance 1 *km* away. If the velocity of sound is 330 *m/s* **[JIPMER 1999]**

(a) His watch is set 3 sec. faster
(b) His watch is set 3 sec. slower
(c) His watch is set correctly
(d) None of the above

34. Velocity of sound in air is **[Pb. PMT 1999; UPSEAT 2000]**

(a) Faster in dry air than in moist air
(b) Directly proportional to pressure
(c) Directly proportional to temperature
(d) Independent of pressure of air

35. Two monoatomic ideal gases 1 and 2 of molecular masses m_1 and m_2 respectively are enclosed in separate containers kept at the same temperature. The ratio of the speed of sound in gas 1 to that in gas 2 is given by **[IIT-JEE Screening 2000]**

(a) $\sqrt{\frac{m_1}{m_2}}$ (b) $\sqrt{\frac{m_2}{m_1}}$
(c) $\frac{m_1}{m_2}$ (d) $\frac{m_2}{m_1}$

36. A man is standing between two parallel cliffs and fires a gun. If he hears first and second echoes after 1.5 *s* and 3.5*s* respectively, the distance between the cliffs is (Velocity of sound in air = 340 ms^{-1}) **[EAMCET (Med.) 2000]**

(a) 1190 *m* (b) 850 *m*
(c) 595 *m* (d) 510 *m*

37. When the temperature of an ideal gas is increased by 600 *K*, the velocity of sound in the gas becomes $\sqrt{3}$ times the initial velocity in it. The initial temperature of the gas is **[EAMCET (Med.) 2000]**

(a) -73^oC (b) 27^oC
(c) 127^oC (d) 327^oC

38. The frequency of a sound wave is *n* and its velocity is *v*. If the frequency is increased to $4n$, the velocity of the wave will be

(a) v (b) $2v$
(c) $4v$ (d) $v/4$

39. The temperature at which the speed of sound in air becomes double of its value at 27^oC is **[CPMT 1997; UPSEAT 2000; DPMT 2003]**

(a) 54^oC (b) 327^oC
(c) 927^oC (d) -123^oC

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

(a) 2 *metres* (b) 4 *metres*
(c) 8 *metres* (d) 16 *metres*

41. Speed of sound at constant temperature depends on **[RPET 2000; AIIMS 1998]**

(a) Pressure (b) Density of gas
(c) Above both (d) None of the above

42. A man standing on a cliff claps his hand hears its echo after 1 *sec*. If sound is reflected from another mountain and velocity of sound in air is 340 *m*/*sec*. Then the distance between the man and reflection point is **[RPET 2000]**

(a) 680 *m* (b) 340 *m*
(c) 85 *m* (d) 170 *m*

43. What will be the wave velocity, if the radar gives 54 waves per min and wavelength of the given wave is 10 *m* **[RPET 2000]**

(a) 4 *m/sec* (b) 6 *m/sec*
(c) 9 *m/sec* (d) 5 *m/sec*

44. Sound velocity is maximum in **[Pb. CET 2000; RPMT 2000]**

(a) H_2 (b) N_2
(c) He (d) O_2

45. The minimum distance of reflector surface from the source for listening the echo of sound is **[CPMT 1997; RPMT 1999; KCET 2000]**

(a) 28 *m* (b) 18 *m*
(c) 19 *m* (d) 16.5 *m*

46. The type of waves that can be propagated through solid is [CPMT 2000]

(a) Transverse (b) Longitudinal
(c) Both (a) and (b) (d) None of these

47. A man stands in front of a hillock and fires a gun. He hears an echo after 1.5 *sec*. The distance of the hillock from the man is (velocity of sound in air is 330 *m/s*) [EAMCET (Eng.) 1998; CPMT 2000]

(a) 220 *m* (b) 247.5 *m*
(c) 268.5 *m* (d) 292.5 *m*

48. Velocity of sound in air

I. Increases with temperature
II. Decreases with temperature
III. Increase with pressure
IV. Is independent of pressure
V. Is independent of temperature

Choose the correct answer. [Kerala (Engg.) 2001]

(a) Only I and II are true (b) Only I and III are true
(c) Only II and III are true (d) Only I and IV are true

49. The speed of a wave in a medium is 760 m/s. If 3600 waves are passing through a point, in the medium in 2 minutes, then its wavelength is [AFMC 1998; CPMT 2001]

(a) 13.8 *m* (b) 25.3 *m*
(c) 41.5 *m* (d) 57.2 *m*

50. If at same temperature and pressure, the densities for two diatomic gases are respectively d_1 and d_2, then the ratio of velocities of sound in these gases will be [CPMT 2001]

(a) $\sqrt{\frac{d_2}{d_1}}$ (b) $\sqrt{\frac{d_1}{d_2}}$
(c) $d_1 d_2$ (d) $\sqrt{d_1 d_2}$

51. The frequency of a tunning fork is 384 per second and velocity of sound in air is 352 *m/s*. How far the sound has traversed while fork completes 36 vibration [KCET 2001]

(a) 3 *m* (b) 13 *m*
(c) 23 *m* (d) 33 *m*

52. v_1 and v_2 are the velocities of sound at the same temperature in two monoatomic gases of densities ρ_1 and ρ_2 respectively. If $\rho_1 / \rho_2 = \frac{1}{4}$ then the ratio of velocities v_1 and v_2 will be [KCET 2000;

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

53. The temperature at which the speed of sound in air becomes double of its value at $0^o C$ is [AIEEE 2002]

(a) 273*K* (b) 546*K*
(c) 1092*K* (d) 0*K*

54. If wavelength of a wave is $\lambda = 6000 Å$. Then wave number will be [MH CET 2002]

(a) $166 \times 10^3\ m^{-1}$ (b) $16.6 \times 10^{-1}\ m^{-1}$
(c) $1.66 \times 10^6\ m^{-1}$ (d) $1.66 \times 10^7\ m^{-1}$

55. Velocity of sound measured in hydrogen and oxygen gas at a given temperature will be in the ratio [RPET 2001; UPSEAT 2001; KCET 2002, 05]

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

56. Find the frequency of minimum distance between compression & rarefaction of a wire. If the length of the wire is 1*m* & velocity of sound in air is 360 *m/s* [CPMT 2003]

(a) 90 sec^{-1} (b) 180s^{-1}
(c) 120 sec^{-1} (d) 360 sec^{-1}

57. The velocity of sound is v_s in air. If the density of air is increased to 4 times, then the new velocity of sound will be [BHU 2003]

(a) $\frac{v_s}{2}$ (b) $\frac{v_s}{12}$
(c) $12 v_s$ (d) $\frac{3}{2} v_s^2$

58. It takes 2.0 seconds for a sound wave to travel between two fixed points when the day temperature is $10^o C$. If the temperature rise to $30^o C$ the sound wave travels between the same fixed parts in [Orissa JEE 2003]

(a) 1.9 *sec* (b) 2.0 *sec*
(c) 2.1 *sec* (d) 2.2 *sec*

59. If v_m is the velocity of sound in moist air, v_d is

the velocity of sound in dry air, under identical conditions of pressure and temperature [KCET 2002, 03]

(a) $v_m > v_d$ (b) $v_m < v_d$

(c) $v_m = v_d$ (d) $v_m v_d = 1$

60. A man, standing between two cliffs, claps his hands and starts hearing a series of echoes at intervals of one second. If the speed of sound in air is 340 ms^{-1}, the distance between the cliffs is [KCET 2004]

(a) 340 *m* (b) 1620 *m*

(c) 680 *m* (d) 1700 *m*

61. A source of sound of frequency 600 *Hz* is placed inside water. The speed of sound in water is 1500 *m/s* and in air is 300 *m/s*. The frequency of sound recorded by an observer who is standing in air is [IIT-JEE Screening 2004]

(a) 200 *Hz* (b) 3000 *Hz*

(c) 120 *Hz* (d) 600 *Hz*

62. If the temperature of the atmosphere is increased the following character of the sound wave is effected

[AFMC 2004]

(a) Amplitude (b) Frequency

(c) Velocity (d) Wavelength

63. An underwater sonar source operating at a frequency of 60 *KHz* directs its beam towards the surface. If the velocity of sound in air is 330 *m/s*, the wavelength and frequency of waves in air are: [DPMT 2004]

(a) 5.5 *mm*, 60 *KHz* (b) 330 *m*, 60 *KHz*

(c) 5.5 *mm*, 20 *KHz* (d) 5.5 *mm*, 80 *KHz*

64. Two sound waves having a phase difference of 60° have path difference of [CBSE PMT 1996; AIIMS 2001]

(a) 2λ (b) $\lambda/2$

(c) $\lambda/6$ (d) $\lambda/3$

65. It is possible to distinguish between the transverse and longitudinal waves by studying the property of

[CPMT 1976; EAMCET 1994]

(a) Interference (b) Diffraction

(c) Reflection (d) Polarisation

66. Water waves are [EAMCET 1979; AIIMS 2004]

(a) Longitudinal

(b) Transverse

(c) Both longitudinal and transverse

(d) Neither longitudinal nor transverse

67. Sound travels in rocks in the form of

[NCERT 1968]

(a) Longitudinal elastic waves only

(b) Transverse elastic waves only

(c) Both longitudinal and transverse elastic waves

(d) Non-elastic waves

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

[EAMCT 1981; AIIMS 1998; DPMT 2000]

(a) Transverse wave (b) Longitudinal waves

(c) Propagated waves (d) None of these

69. A medium can carry a longitudinal wave because it has the property of

[KCET 1994]

(a) Mass (b) Density

(c) Compressibility (d) Elasticity

70. Which of the following is the longitudinal wave

[AFMC 1997]

(a) Sound waves (b) Waves on plucked string

(c) Water waves (d) Light waves

71. The nature of sound waves in gases is

[RPMT 1999; RPET 2000; J & K CET 2004]

(a) Transverse (b) Longitudinal

(c) Stationary (d) Electromagnetic

72. Transverse waves can propagate in

[CPMT 1984; KCET 2000; RPET 2001]

(a) Liquids (b) Solids

(c) Gases (d) None of these

73. Sound waves in air are [RPET 2000; AFMC 2001]

(a) Transverse (b) Longitudinal

(c) De-Broglie waves (d) All the above

74. Which of the following is not the transverse wave

[AFMC 1999; BHU 2001]

(a) X-rays (b) γ -rays

(c) Visible light wave (d) Sound wave in a gas

75. What is the phase difference between two successive crests in the wave **[RPMT 2001, 02; MH CET 2004]**

(a) π (b) $\pi/2$

(c) 2π (d) 4π

76. A wave of frequency 500 *Hz* has velocity 360 *m*/*sec*. The distance between two nearest points 60° out of phase, is

[NCERT 1979; MP PET 1989; JIPMER 1997; RPMT 2002, 03; CPMT 1979, 90, 2003; BCECE 2005]

(a) 0.6 *cm* (b) 12 *cm*

(c) 60 *cm* (d) 120 *cm*

77. The following phenomenon cannot be observed for sound waves **[NCERT 1982; CPMT 1985, 97; AFMC 2002; RPMT 2003]**

(a) Refraction (b) Interference

(c) Diffraction (d) Polarisation

78. When an aeroplane attains a speed higher than the velocity of sound in air, a loud bang is heard. This is because

[NCERT 1972; J & K CET 2002]

(a) It explodes

(b) It produces a shock wave which is received as the bang

(c) Its wings vibrate so violently that the bang is heard

(d) The normal engine noises undergo a Doppler shift to generate the bang

79. Ultrasonic waves are those waves **[CPMT 1979]**

(a) To which man can hear (b) Man can't hear

(c) Are of high velocity (d) Of high amplitude

80. A big explosion on the moon cannot be heard on the earth because **[CPMT 1972; AFMC 2005]**

(a) The explosion produces high frequency sound waves which are inaudible

(b) Sound waves required a material medium for propagation

(c) Sound waves are absorbed in the moon's atmosphere

(d) Sound waves are absorbed in the earth's atmosphere

81. Sound waves of wavelength greater than that of audible sound are called **[KCET 1999]**

(a) Seismic waves (b) Sonic waves

(c) Ultrasonic waves (d) Infrasonic waves

82. 'SONAR' emits which of the following waves

[AIIMS 1999]

(a) Radio waves (b) Ultrasonic waves

(c) Light waves (d) Magnetic waves

83. Which of the following do not require medium for transmission **[RPMT 2000]**

(a) Cathode ray (b) Electromagnetic wave

(c) Sound wave (d) None of the above

84. Consider the following

I. Waves created on the surfaces of a water pond by a vibrating sources.

II. Wave created by an oscillating electric field in air.

III. Sound waves travelling under water.

Which of these can be polarized

(a) I and II (b) II only

(c) II and III (d) I, II and III

85. Mechanical waves on the surface of a liquid are

[SCRA 1996]

(a) Transverse

(b) Longitudinal

(c) Torsional

(d) Both transverse and longitudinal

86. The ratio of densities of nitrogen and oxygen is 14:16. The temperature at which the speed of sound in nitrogen will be same at that in oxygen at 55°*C* is

[EAMCET (Engg.) 1999]

(a) 35°*C* (b) 48°*C*

(c) 65°*C* (d) 14°*C*

87. The intensity of sound increases at night due to

[CPMT 2000]

(a) Increase in density of air (b) Decreases in density of air

(c) Low temperature (d) None of these

88. A wavelength 0.60 *cm* is produced in air and it travels at a speed of 300 ms^{-1}. It will be an **[UPSEAT 2000]**

(a) Audible wave (b) Infrasonic wave

(c) Ultrasonic wave (d) None of the above

89. Speed of sound in mercury at a certain temperature is 1450 *m/s*. Given the density of mercury as 13.6 × 10^3 kg / m^3, the bulk modulus for mercury is **[JIPMER 2000]**

(a) 2.86 ×10^{10} N/m^3 (b) 3.86 ×10^{10} N/m^3

(c) 4.86 ×10^{10} N/m^3 (d) 5.86 ×10^{10} N/m^3

90. A micro-wave and an ultrasonic sound wave have the same wavelength. Their frequencies are in the ratio (approximately) **[Kerala (Engg.) 2002]**

(a) $10^6 : 1$ (b) $10^4 : 1$

(c) $10^2 : 1$ (d) 10 : 1

91. A point source emits sound equally in all directions in a non-absorbing medium, Two points *P* and *Q* are at distance of 2*m* and 3*m* respectively from the source. The ratio of the intensities of the waves at *P* and *Q* is **[CBSE PMT 2005]**

(a) 9 : 4 (b) 2 : 3

(c) 3 : 2 (d) 4 : 9

92. A wave has velocity *u* in medium *P* and velocity 2*u* in medium *Q*. If the wave is incident in medium *P* at an angle of 30° then the angle of refraction will be **[J & K CET 2005]**

(a) 30° (b) 45°

(c) 60° (d) 90°

93. An observer standing near the sea shore observes 54 waves per minute. If the wavelength of the water wave is 10*m* then the velocity of water wave is **[Kerala (Engg.) 2005]**

(a) 540 ms^{-1} (b) 5.4 ms^{-1}

(c) 0.184 ms^{-1} (d) 9 ms^{-1}

94. Ultrasonic signal sent from SONAR returns to it after reflection from a rock after a lapse of 1 *sec*. If the velocity of ultrasound in water is 1600 ms^{-1}, the depth of the rock in water is **[JIPMER 2000]**

(a) 300 *m* (b) 400 *m*

(c) 500 *m* (d) 800 *m*

Progressive Waves

1. The equation of a wave is $y = 2\sin\pi(0.5x - 200t)$, where *x* and *y* are expressed in cm and *t* in sec. The wave velocity is **[MP PMT 1986]**

(a) 100 *cm/sec* (b) 200 *cm/sec*

(c) 300 *cm/sec* (d) 400 *cm/sec*

2. Equation of a progressive wave is given by

$$y = 0.2\cos\pi\left(0.04t + .02x - \frac{\pi}{6}\right)$$

The distance is expressed in *cm* and time in second. What will be the minimum distance between two particles having the phase difference of $\pi/2$

(a) 4 *cm* (b) 8 *cm*

(c) 25 *cm* (d) 12.5 *cm*

3. A travelling wave passes a point of observation. At this point, the time interval between successive crests is 0.2 seconds and **[MP PMT 1990]**

(a) The wavelength is 5 *m*

(b) The frequency is 5 *Hz*

(c) The velocity of propagation is 5 *m/s*

(d) The wavelength is 0.2 *m*

4. The equation of a transverse wave is given by

$$y = 10\sin\pi(0.01x - 2t)$$

where *x* and *y* are in *cm* and *t* is in second. Its frequency is **[MP PET 1990; MNR 1986; RPET 2003]**

(a) $10\,sec^{-1}$ (b) $2\,sec^{-1}$

(c) $1\,sec^{-1}$ (d) $0.01\,sec^{-1}$

5. At a moment in a progressive wave, the phase of a particle executing S.H.M. is $\frac{\pi}{3}$. Then the phase of the particle 15 *cm* ahead and at the time $\frac{T}{2}$ will be, if the wavelength is 60 *cm*

(a) $\frac{\pi}{2}$ (b) $\frac{2\pi}{3}$

(c) Zero (d) $\frac{5\pi}{6}$

6. The equation of a wave travelling on a string is $y = 4\sin\frac{\pi}{2}\left(8t - \frac{x}{8}\right)$. If *x* and *y* are in *cm*, then velocity of wave is **[MP PET 1990]**

(a) 64 *cm/sec* in – *x* direction

(b) 32 *cm/sec* in – *x* direction

(c) 32 *cm/sec* in + *x* direction

(d) 64 *cm/sec* in + *x* direction

7. The equation of a progressive wave is given by

$$y = a\sin(628t - 31.4x)$$

If the distances are expressed in *cms* and time in seconds, then the wave velocity will be **[DPMT 1999]**

(a) 314 *cm/sec* (b) 628 *cm/sec*
(c) 20 *cm/sec* (d) 400 *cm/sec*

8. Two waves are given by $y_1 = a\sin(\omega t - kx)$ and $y_2 = a\cos(\omega t - kx)$ The phase difference between the two waves is **[MP PMT 1993; SCRA 1996; CET 1998; EAMCET 1991; Orissa JEE 2002]**

(a) $\frac{\pi}{4}$ (b) π
(c) $\frac{\pi}{8}$ (d) $\frac{\pi}{2}$

9. If amplitude of waves at distance *r* from a point source is A, the amplitude at a distance 2*r* will be **[MP PMT 1985]**

(a) 2*A* (b) *A*
(c) *A*/2 (d) *A*/4

10. The relation between time and displacement for two particles is given by

$y_1 = 0.06\sin 2\pi(0.04t + \phi_1)$, $y_2 = 0.03\sin 2\pi(1.04t + \phi_2)$

The ratio of the intensity of the waves produced by the vibrations of the two particles will be **[MP PMT 1991]**

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

11. A wave is reflected from a rigid support. The change in phase on reflection will be **[MP PMT 1990; RPMT 2002]**

(a) $\pi/4$ (b) $\pi/2$
(c) π (d) 2π

12. A plane wave is represented by

$x = 1.2\sin(314\,t + 12.56y)$

Where *x* and *y* are distances measured along in *x* and *y* direction in meters and *t* is time in seconds. This wave has **[MP PET 1991]**

(a) A wavelength of 0.25 *m* and travels in + *ve x* direction
(b) A wavelength of 0.25 *m* and travels in + *ve y* direction
(c) A wavelength of 0.5 *m* and travels in – *ve y* direction
(d) A wavelength of 0.5 *m* and travels in – *ve x* direction

13. The displacement *y* (in *cm*) produced by a simple harmonic wave is $y = \frac{10}{\pi}\sin\left(2000\pi t - \frac{\pi x}{17}\right)$. The periodic time and maximum velocity of the particles in the medium will respectively be **[CPMT 1986]**

(a) 10^{-3} *sec* and 330 *m/sec* (b) 10^{-4} sec and 20 *m/sec*
(c) 10^{-3} *sec* and 200 *m/sec* (d) 10^{-2} *sec* and 2000 *m/sec*

14. The equation of a wave travelling in a string can be written as $y = 3\cos\pi(100\,t - x)$. Its wavelength is **[MNR 1985; CPMT 1991; MP PMT 1994, 97; Pb. PET 2004]**

(a) 100 *cm* (b) 2 *cm*
(c) 5 *cm* (d) None of the above

15. 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 four times the wave velocity if **[IIT 1984; MP PMT 1997; EAMCET; 1998; CBSE PMT 2000; AFMC 2000; MP PMT/PET 1998; 01; KCET 1999, 04; Pb. PET 2001; DPMT 2005]**

(a) $\lambda = \frac{\pi Y_0}{4}$ (b) $\lambda = \frac{\pi Y_0}{2}$
(c) $\lambda = \pi Y_0$ (d) $\lambda = 2\pi Y_0$

16. A wave equation which gives the displacement along the *Y* direction is given by the equation $y = 10^4\sin(60t + 2x)$, where *x* and *y* are in *metres* and *t* is time in seconds. This represents a wave **[MNR 1983; IIT 1982; RPMT 1998; MP PET 2001]**

(a) Travelling with a velocity of 30 *m/sec* in the negative *X* direction
(b) Of wavelength π *metre*
(c) Of frequency 30/π *Hz*
(d) Of amplitude 10^4 *metre* travelling along the negative *X* direction

17. A transverse wave of amplitude 0.5 *m* and wavelength 1 *m* and frequency 2 *Hz* is propagating in a string in the negative *x*-direction. The expression for this wave is **[AIIMS 1980]**

(a) $y(x, t) = 0.5\sin(2\pi x - 4\pi t)$
(b) $y(x, t) = 0.5\cos(2\pi x + 4\pi t)$
(c) $y(x, t) = 0.5\sin(\pi x - 2\pi t)$

(d) $y(x,t)=0.5\cos(2\pi x+2\pi t)$

18. The displacement of a particle is given by $y=5\times10^{-4}\sin(100t-50x)$, where *x* is in meter and *t* in sec, find out the velocity of the wave **[CPMT 1982]**

(a) 5000 *m/sec* (b) 2 *m/sec*
(c) 0.5 *m/sec* (d) 300 *m/sec*

19. Which one of the following does not represent a travelling wave **[NCERT 1984]**

(a) $y=\sin(x-vt)$ (b) $y=y_m\sin k(x+vt)$
(c) $y=y_m\log(x-vt)$ (d) $y=f(x^2-vt^2)$

20. A wave represented by the given equation $Y=A\sin\left(10\pi x+15\pi t+\frac{\pi}{3}\right)$, where *x* is in meter and *t* is in second. The expression represents **[IIT 1990]**

(a) A wave travelling in the positive *X* direction with a velocity of 1.5 *m/sec*
(b) A wave travelling in the negative *X* direction with a velocity of 1.5 *m/sec*
(c) A wave travelling in the negative *X* direction with a wavelength of 0.2 *m*
(d) A wave travelling in the positive *X* direction with a wavelength of 0.2 *m*

21. A plane wave is described by the equation $y=3\cos\left(\frac{x}{4}-10t-\frac{\pi}{2}\right)$. The maximum velocity of the particles of the medium due to this wave is **[MP PMT 1994]**

(a) 30 (b) $\frac{3\pi}{2}$
(c) 3/4 (d) 40

22. The path difference between the two waves $y_1=a_1\sin\left(\omega t-\frac{2\pi x}{\lambda}\right)$ and $y_2=a_2\cos\left(\omega t-\frac{2\pi x}{\lambda}+\phi\right)$ is **[MP PMT 1994]**

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

23. Wave equations of two particles are given by $y_1=a\sin(\omega t-kx)$, $y_2=a\sin(kx+\omega t)$, then **[BHU 1995]**

(a) They are moving in opposite direction
(b) Phase between them is 90°
(c) Phase between them is 180°
(d) Phase between them is 0°

24. A wave is represented by the equation $y=0.5\sin(10t-x)m$. It is a travelling wave propagating along the + *x* direction with velocity **[Roorkee 1995]**

(a) 10 *m/s* (b) 20 *m/s*
(c) 5 *m/s* (d) None of these

25. A wave is represented by the equation

$$y=7\sin\left(7\pi t-0.04\,x\pi+\frac{\pi}{3}\right)$$

x is in *metres* and *t* is in seconds. The speed of the wave is **[MP PET 1996; AMU (Engg.) 1999]**

(a) 175 *m/sec* (b) 49 *πm/sec*
(c) 49 *πm/sec* (d) 0.28 *πm/sec*

26. The equation of a transverse wave travelling on a rope is given by $y=10\sin\pi(0.01x-2.00t)$ where *y* and *x* are in *cm* and *t* in seconds. The maximum transverse speed of a particle in the rope is about **[MP PET 1999; AIIMS 2000]**

(a) 63 *cm/s* (b) 75 *cm/s*
(c) 100 *cm/s* (d) 121 *cm/s*

27. As a wave propagates **[IIT-JEE 1999]**

(a) The wave intensity remains constant for a plane wave
(b) The wave intensity decreases as the inverse of the distance from the source for a spherical wave
(c) The wave intensity decreases as the inverse square of the distance from the source for a spherical wave
(d) Total intensity of the spherical wave over the spherical surface centered at the source remains constant at all times

28. A transverse wave is represented by the equation

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

For what value of λ, the maximum particle velocity equal to two times the wave velocity **[CBSE PMT 1998; JIPMER 2001, 02; AFMC 2002]**

(a) $\lambda=2\pi y_0$ (b) $\lambda=\pi y_0/3$
(c) $\lambda=\pi y_0/2$ (d) $\lambda=\pi y_0$

29. A travelling wave in a stretched string is described by the equation $y=A\sin(kx-\omega t)$. The maximum particle velocity is

[IIT 1997 Re-Exam; UPSEAT 2004]

(a) $A\omega$ (b) ω/k

(c) $d\omega/dk$ (d) x/t

30. 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 *metres* and t in seconds. The wavelength of the wave is **[EAMCET 1994; CPMT 2004]**

(a) 200 m (b) 100 m

(c) 20 m (d) 10 m

31. The particles of a medium vibrate about their mean positions whenever a wave travels through that medium. The phase difference between the vibrations of two such particles **[SCRA 1994]**

(a) Varies with time

(b) Varies with distance separating them

(c) Varies with time as well as distance

(d) Is always zero

32. A wave is given by $y = 3\sin 2\pi\left(\frac{t}{0.04} - \frac{x}{0.01}\right)$, where y is in *cm*. Frequency of wave and maximum acceleration of particle will be **[RPET 1997]**

(a) $100\,Hz, 4.7\times 10^3\ cm/s^2$ (b) $50\,Hz, 7.5\times 10^3\ cm/s^2$

(c) $25\,Hz, 4.7\times 10^4\ cm/s^2$ (d) $25\,Hz, 7.4\times 10^4\ cm/s^2$

33. Equation of a progressive wave is given by

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

Then which of the following is correct **[CBSE PMT 1993]**

(a) $v = 5\,m/\sec$ (b) $\lambda = 18\,m$

(c) $a = 0.04\,m$ (d) $n = 50\,Hz$

34. With the propagation of a longitudinal wave through a material medium, the quantities transmitted in the propagation direction are **[CBSE PMT 1992; Roorkee 2000]**

(a) Energy, momentum and mass

(b) Energy

(c) Energy and mass

(d) Energy and linear momentum

35. The frequency of the sinusoidal wave $y = 0.40\cos[2000\,t + 0.80\,x]$ would be **[CBSE PMT 1992]**

(a) $1000\,\pi\,Hz$ (b) 2000 Hz

(c) 20 Hz (d) $\frac{1000}{\pi}\,Hz$

36. Which of the following equations represents a wave **[CBSE PMT 1994; JIPMER 2000]**

(a) $Y = A(\omega t - kx)$ (b) $Y = A\sin\omega t$

(c) $Y = A\cos kx$ (d) $Y = A\sin(at - bx + c)$

37. The equation of a transverse wave is given by

$y = 100\sin\pi(0.04z - 2t)$

where y and z are in *cm* ant t is in seconds. The frequency of the wave in *Hz* is **[SCRA 1998]**

(a) 1 (b) 2

(c) 25 (d) 100

38. The equation of a plane progressive wave is given by $y = 0.025\sin(100t + 0.25x)$. The frequency of this wave would be **[CPMT 1993; JIPMER 2001, 02]**

(a) $\frac{50}{\pi}\,Hz$ (b) $\frac{100}{\pi}\,Hz$

(c) 100 Hz (d) 50 Hz

39. The equation of a sound wave is

$y = 0.0015\sin(62.4x + 316t)$

The wavelength of this wave is **[CBSE PMT 1996; AFMC 2002; AIIMS 2002]**

(a) 0.2 unit (b) 0.1 unit

(c) 0.3 unit (d) Cannot be calculated

40. In the given progressive wave equation, what is the maximum velocity of particle $Y = 0.5\sin(10\pi t - 5x)\ cm$ **[BHU 1997]**

(a) 5 cm/s (b) $5\pi\ cm/s$

(c) 10 cm/s (d) 10.5 cm/s

41. A pulse or a wave train travels along a stretched string and reaches the fixed end of the string. It will be reflected back with **[CBSE PMT 1997]**

(a) The same phase as the incident pulse but with velocity reversed

(b) A phase change of 180° with no reversal of velocity

(c) The same phase as the incident pulse with no reversal of velocity

(d) A phase change of 180° with velocity reversed

42. The equation of a travelling wave is

$y = 60\cos(1800t - 6x)$

where y is in microns, t in seconds and x in metres. The ratio of maximum particle velocity to velocity of wave propagation is **[CBSE PMT 1997; JIPMER 2001, 02]**

(a) 3.6×10^{-11} (b) 3.6×10^{-6}

(c) 3.6×10^{-4} (d) 3.6

43. The wave equation is $y = 0.30\sin(314t - 1.57x)$ where t, x and y are in second, meter and centimeter respectively. The speed of the wave is

[CPMT 1997; AFMC 1999; CPMT 2001]

(a) 100 *m/s* (b) 200 *m/s*

(c) 300 *m/s* (d) 400 *m/s*

44. Equation of the progressive wave is given by : $y = a\sin\pi(40t - x)$ where a and x are in *metre* and t in second. The velocity of the wave is **[KCET 1999]**

(a) 80 *m/s* (b) 10 *m/s*

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

45. Progressive wave of sound is represented by $y = a\sin[400\pi t - \pi x / 6.85]$ where x is in m and t is in sec. Frequency of the wave will be **[RPMT 1999]**

(a) 200 *Hz* (b) 400 *Hz*

(c) 500 *Hz* (d) 600 *Hz*

46. Two waves of frequencies 20 *Hz* and 30 *Hz*. Travels out from a common point. The phase difference between them after 0.6 *sec* is

(a) Zero (b) $\frac{\pi}{2}$

(c) π (d) $\frac{3\pi}{4}$

47. The phase difference between two points separated by 0.8 *m* in a wave of frequency 120 *Hz* is 90^o. Then the velocity of wave will be

(a) 192 *m/s* (b) 360 *m/s*

(c) 710 *m/s* (d) 384 *m/s*

48. The equation of progressive wave is

$y = 0.2\sin 2\pi\left[\frac{t}{0.01} - \frac{x}{0.3}\right]$, where x and y are in metre and t is in second. The velocity of propagation of the wave is

(a) 30 *m/s* (b) 40 *m/s*

(c) 300 *m/s* (d) 400 *m/s*

49. If the equation of transverse wave is $y = 5\sin 2\pi\left[\frac{t}{0.04} - \frac{x}{40}\right]$, where distance is in *cm* and time in second, then the wavelength of the wave is

[MH CET 2000; DPMT 2003]

(a) 60 *cm* (b) 40 *cm*

(c) 35 *cm* (d) 25 *cm*

50. A wave is represented by the equation : $y = a\sin(0.01x - 2t)$ where a and x are in *cm*. velocity of propagation of wave is

[EAMCET 1994; AIIMS 2000; Pb. PMT 2003]

(a) 10 *cm/s* (b) 50 *cm/s*

(c) 100 *cm/s* (d) 200 *cm/s*

51. A simple harmonic progressive wave is represented by the equation : $y = 8\sin 2\pi(0.1x - 2t)$ where x and y are in *cm* and t is in seconds. At any instant the phase difference between two particles separated by 2.0 *cm* in the *x*-direction is

[MP PMT 2000]

(a) 18° (b) 36°

(c) 54° (d) 72°

52. The intensity of a progressing plane wave in loss-free medium is **[Roorkee 2000]**

(a) Directly proportional to the square of amplitude of the wave

(b) Directly proportional to the velocity of the wave

(c) Directly proportional to the square of frequency of the wave **[JIPMER 1999]**

(d) Inversely proportional to the density of the medium

53. The equation of progressive wave is $y = a\sin(200t - x)$. where x is in meter and t is in second. The velocity of wave is

(a) 200 *m/sec* (b) 100 *m/sec*

[MH CET 1999] (c) 50 *m/sec* (d) None of these

54. A wave is represented by the equation $y = 7\sin\{\pi(2t - 2x)\}$ where x is in *metres* and t in seconds. The velocity of the wave is

[CPMT 2000; CBSE PMT 2000; Pb. PET 2000]

(a) 1 *m/s* (b) 2 *m/s*

(c) 5 *m/s* (d) 10 *m/s*

55. **[KCET 2000]** The equation of a longitudinal wave is represented as $y = 20\cos\pi(50t - x)$. Its wavelength is

[UPSEAT 2001; Orissa PMT 2004]

(a) 5 *cm* (b) 2 *cm*

(c) 50 *cm* (d) 20 *cm*

56. A wave equation which gives the displacement along y-direction is given by $y = 0.001\sin(100t + x)$ where x and y are in meterand t is time in second. This represented a wave

[UPSEAT 2001]

(a) Of frequency $\frac{100}{\pi}$ *Hz*

(b) Of wavelength one metre

(c) Travelling with a velocity of $\frac{50}{\pi}$ ms^{-1} in the positive X-direction

(d) Travelling with a velocity of 100 ms^{-1} in the negative X-direction

57. A transverse wave is given by $y = A\sin 2\pi\left(\frac{t}{T} - \frac{x}{\lambda}\right)$. The maximum particle velocity is equal to 4 times the wave velocity when **[MP PMT 2001]**

(a) $\lambda = 2\pi A$ (b) $\lambda = \frac{1}{2}\pi A$

(c) $\lambda = \pi A$ (d) $\lambda = \frac{1}{4}\pi A$

58. The equation of a wave is represented by $y = 10^{-4}\sin\left[100t - \frac{x}{10}\right]$. The velocity of the wave will be

[CBSE PMT 2001]

(a) 100 *m/s* (b) 250 *m/s*

(c) 750 *m/s* (d) 1000 *m/s*

59. A wave travelling in positive X-direction with $A = 0.2m$ has a velocity of 360 *m/sec*. if $\lambda = 60m$, then correct expression for the wave is

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

60. The equation of a wave motion (with t in seconds and x in *metres*) is given by $y = 7\sin\left[7\pi t - 0.4\pi x + \frac{\pi}{3}\right]$. The velocity of the wave will be

[BHU 2002]

(a) 17.5 *m/s* (b) 49π *m/s*

(c) $\frac{49}{2\pi} m/s$ (d) $\frac{2\pi}{49} m/s$

61. Two waves represented by the following equations are travelling in the same medium $y_1 = 5\sin 2\pi(75t - 0.25x)$, $y_2 = 10\sin 2\pi(150t - 0.50x)$

The intensity ratio I_1 / I_2 of the two waves is

[UPSEAT 2002]

(a) 1 : 2 (b) 1 : 4

(c) 1 : 8 (d) 1 : 16

62. The equation of a progressive wave is $y = 8\sin\left[\pi\left(\frac{t}{10} - \frac{x}{4}\right) + \frac{\pi}{3}\right]$. The wavelength of the wave is

[MH CET 2002]

(a) 8 *m* (b) 4 *m*

(c) 2 *m* (d) 10 *m*

63. Which of the following is not true for this progressive wave $y = 4\sin 2\pi\left(\frac{t}{0.02} - \frac{x}{100}\right)$ where y and x are in cm & t in *sec*

(a) Its amplitude is 4 *cm*

(b) Its wavelength is 100 *cm*

(c) Its frequency is 50 *cycles/sec*

(d) Its propagation velocity is 50×10^3 *cm/sec*

64. The equation of a wave is given as $y = 0.07\sin(12\pi x - 3000\pi t)$. Where x is in *metre* and t in sec, then the correct statement is

(a) $\lambda = 1/6m, v = 250m/s$ (b) $a = 0.07m, v = 300m/s$

(c) $n = 1500, v = 200m/s$ (d) None

65. The equation of the propagating wave is $y = 25\sin(20t + 5x)$, where y is displacement. Which of the following statement is not true

[CBSE PMT 2002; KCET 2003]

(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

66. In a plane progressive wave given by $y = 25\cos(2\pi t - \pi x)$, the amplitude and frequency are respectively

[BCECE 2003]

(a) 25,100 (b) 25, 1

(c) 25, 2 (d) 50π, 2

67. The displacement y of a wave travelling in the x-direction is given by $y = 10^{-4}\sin\left(600t - 2x + \frac{\pi}{3}\right)$ metres, where x is expressed in metres and t in seconds. The speed of the wave-motion, in ms^{-1}, is **[AIEEE 2003]**

(a) 200 (b) 300

(c) 600 (d) 1200

68. The displacement y of a particle in a medium can be expressed as: $y = 10^{-6}\sin(100t + 20x + \pi/4)m$, where t is in second and x in *meter*. The speed of wave is **[AIEEE 2004]**

(a) 2000 *m/s* (b) 5 *m/s*

(c) 20 *m/s* (d) $5\pi\ m/s$

69. If the wave equation $y = 0.08\sin\frac{2\pi}{\lambda}(200t - x)$ then the velocity of the wave will be **[BCECE 2004]**

(a) $400\sqrt{2}$ (b) $200\sqrt{2}$

(c) 400 (d) 200

70. The phase difference between two points separated by 0.8 *m* in a wave of frequency is 120 *Hz* is $\frac{\pi}{2}$. The velocity of wave is **[Pb. PET 2000]**

(a) 720 *m/s* (b) 384 *m/s*

(c) 250 *m/s* (d) 1 *m/s*

71. A plane progressive wave is represented by the equation

$y = 0.1\sin\left(200\pi t - \frac{20\pi x}{17}\right)$ where y is displacement in *m*, *t* in second and *x* is distance from a fixed origin in *meter*. The frequency, wavelength and speed of the wave respectively are **[Pb. PET 2001]**

(a) 100 *Hz*, 1.7 *m*, 170 *m/s* (b) 150 *Hz*, 2.4 *m*, 200 *m/s*

(c) 80 *Hz*, 1.1 *m*, 90 *m/s* (d) 120 *Hz*, 1.25 *m*, 207 *m/s*

72. The equation of a travelling wave is given by $y = 0.5\sin(20x - 400t)$ where *x* and *y* are in *meter* and *t* is in *second*. The velocity of the wave is **[UPSEAT 2004]**

(a) 10 *m/s* (b) 20 *m/s*

(c) 200 *m/s* (d) 400 *m/s*

73. A transverse progressive wave on a stretched string has a velocity of $10\,ms^{-1}$ and a frequency of 100 *Hz*. The phase difference between two particles of the string which are 2.5 *cm* apart will be **[MP PMT 1994]**

(a) $\frac{\pi}{8}$ (b) $\frac{\pi}{4}$

(c) $\frac{3\pi}{8}$ (d) $\frac{\pi}{2}$

74. A transverse sinusoidal wave of amplitude *a*, wavelength λ and frequency *n* is travelling on a stretched string. The maximum speed of any point on the string is *v*/10, where *v* is the speed of propagation of the wave. If $a = 10^{-3}\,m$ and $v = 10\,ms^{-1}$, then λ and *n* are given by **[IIT 1998]**

(a) $\lambda = 2\pi \times 10^{-2}\,m$ (b) $\lambda = 10^{-3}\,m$

(c) $n = \frac{10^3}{2\pi}\,Hz$ (d) $n = 10^4\,Hz$

75. When a longitudinal wave propagates through a medium, the particles of the medium execute simple harmonic oscillations about their mean positions. These oscillations of a particle are characterised by an invariant **[SCRA 1998]**

(a) Kinetic energy

(b) Potential energy

(c) Sum of kinetic energy and potential energy

(d) Difference between kinetic energy and potential energy

76. Equation of a progressive wave is given by $y = a\sin\pi\left[\frac{t}{2} - \frac{x}{4}\right]$, where *t* is in seconds and *x* is in meters. The distance through which the wave moves in 8 *sec* is (in meter) **[KCET 1998]**

(a) 8 (b) 16

(c) 2 (d) 4

77. The phase difference between two waves represented by

$y_1 = 10^{-6}\sin[100\,t + (x/50) + 0.5]m$

$y_2 = 10^{-6}\cos[100\,t + (x/50)]m$

where *x* is expressed in metres and *t* is expressed in seconds, is approximately **[CBSE PMT 2004]**

(a) 1.5 *rad* (b) 1.07 *rad*

(c) 2.07 *rad* (d) 0.5 *rad*

78. Equation 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 **[CPMT 2004]**

(a) $2a\cos\theta$ (b) $\sqrt{2}a\cos\theta$

(c) $4a\cos\theta/2$ (d) $\sqrt{2}a\cos\theta/2$

79. A particle on the trough of a wave at any instant will come to the mean position after a time (T = time period) **[KCET 2005]**

(a) $T/2$ (b) $T/4$

(c) T (d) $2T$

80. If the equation of transverse wave is $Y = 2\sin(kx - 2t)$, then the maximum particle velocity is **[Orissa JEE 2005]**

(a) 4 units (b) 2 units

(c) 0 (d) 6 units

Interference and Superposition of Waves

1. There is a destructive interference between the two waves of wavelength λ coming from two different paths at a point. To get maximum sound or constructive interference at that point, the path of one wave is to be increased by **[MP PET 1985]**

(a) $\frac{\lambda}{4}$ (b) $\frac{\lambda}{2}$

(c) $\frac{3\lambda}{4}$ (d) λ

2. When two sound waves with a phase difference of $\pi/2$, and each having amplitude A and frequency ω, are superimposed on each other, then the maximum amplitude and frequency of resultant wave is **[MP PMT 1989]**

(a) $\frac{A}{\sqrt{2}} : \frac{\omega}{2}$ (b) $\frac{A}{\sqrt{2}} : \omega$

(c) $\sqrt{2}A : \frac{\omega}{2}$ (d) $\sqrt{2}A : \omega$

3. If the phase difference between the two wave is 2π during superposition, then the resultant amplitude is **[DPMT 2001]**

(a) Maximum (b) Minimum

(c) Maximum or minimum (d)None of the above

4. The superposition takes place between two waves of frequency f and amplitude a. The total intensity is directly proportional to **[MP PMT 1986]**

(a) a (b) $2a$

(c) $2a^2$ (d) $4a^2$

5. If two waves of same frequency and same amplitude respectively, on superimposition produced a resultant disturbance of the same amplitude, the waves differ in phase by **[MP PMT 1990; MP PET 2000]**

(a) π (b) $2\pi/3$

(c) $\pi/2$ (d) Zero

6. Two sources of sound A and B produces the wave of 350 *Hz*, they vibrate in the same phase. The particle P is vibrating under the influence of these two waves, if the amplitudes at the point P produced by the two waves is 0.3 *mm* and 0.4 *mm*, then the resultant amplitude of the point P will be when $AP - BP$ = 25 *cm* and the velocity of sound is 350 *m/sec*

(a) 0.7 *mm* (b) 0.1 *mm*

(c) 0.2 *mm* (d) 0.5 *mm*

7. Two waves are propagating to the point P along a straight line produced by two sources A and B of simple harmonic and of equal frequency. The amplitude of every wave at P is 'a' and the phase of A is ahead by $\frac{\pi}{3}$ than that of B and the distance AP is greater than BP by 50 *cm*. Then the resultant amplitude at the point P will be, if the wavelength is 1 *meter* **[BVP 2003]**

(a) $2a$ (b) $a\sqrt{3}$

(c) $a\sqrt{2}$ (d) a

8. Coherent sources are characterized by the same **[KCET 1993]**

(a) Phase and phase velocity

(b) Wavelength, amplitude and phase velocity

(c) Wavelength, amplitude and frequency

(d) Wavelength and phase

9. The minimum intensity of sound is zero at a point due to two sources of nearly equal frequencies, when

(a) Two sources are vibrating in opposite phase

(b) The amplitude of two sources are equal

(c) At the point of observation, the amplitudes of two S.H.M. produced by two sources are equal and both the S.H.M. are along the same straight line

(d) Both the sources are in the same phase

10. Two sound waves (expressed in CGS units) given by $y_1 = 0.3\sin\frac{2\pi}{\lambda}(vt - x)$ and $y_2 = 0.4\sin\frac{2\pi}{\lambda}(vt - x + \theta)$ interfere. The resultant amplitude at a place where phase difference is $\pi/2$ will be **[MP PET 1991]**

(a) 0.7 *cm* (b) 0.1 *cm*

(c) 0.5 *cm* (d) $\frac{1}{10}\sqrt{7}\ cm$

11. If two waves having amplitudes 2*A* and *A* and same frequency and velocity, propagate in the same direction in the same phase, the resulting amplitude will be **[MP PET 1991; DPMT 1999]**

(a) 3*A* (b) $\sqrt{5}A$

(c) $\sqrt{2}A$ (d) *A*

12. The intensity ratio of two waves is 1 : 16. The ratio of their amplitudes is **[EAMCET 1983]**

(a) 1 : 16 (b) 1 : 4

(c) 4 : 1 (d) 2 : 1

13. Out of the given four waves (1), (2), (3) and (4)

$y = a\sin(kx + \omega t)$ ......(1)

$y = a\sin(\omega t - kx)$ ......(2)

$y = a\cos(kx + \omega t)$ ......(3)

$y = a\cos(\omega t - kx)$ ......(4)

emitted by four different sources S_1, S_2, S_3 and S_4 respectively, interference phenomena would be observed in space under appropriate conditions when **[CPMT 1988]**

(a) Source S_1 emits wave (1) and S_2 emits wave (2)

(b) Source S_3 emits wave (3) and S_4 emits wave (4)

(c) Source S_2 emits wave (2) and S_4 emits wave (4)

(d) S_4 emits waves (4) and S_3 emits waves (3)

14. Two waves of same frequency and intensity superimpose with each other in opposite phases, then after superposition the **[AFMC 1995]**

(a) Intensity increases by 4 times

(b) Intensity increases by two times

(c) Frequency increases by 4 times

(d) None of these

15. The superposing waves are represented by the following equations :

$y_1 = 5\sin 2\pi(10t - 0.1x)$, $y_2 = 10\sin 2\pi(20t - 0.2x)$

Ratio of intensities $\frac{I_{max}}{I_{min}}$ will be **[AIIMS 1995; KCET 2001]**

(a) 1 (b) 9

(c) 4 (d) 16

16. The displacement of a particle is given by

$x = 3\sin(5\pi t) + 4\cos(5\pi t)$

The amplitude of the particle is **[MP PMT 1999]**

(a) 3 (b) 4

(c) 5 (d) 7

17. Two waves

$y_1 = A_1\sin(\omega t - \beta_1)$, $y_2 = A_2\sin(\omega t - \beta_2)$

Superimpose to form a resultant wave whose amplitude is **[CPMT 1999]**

(a) $\sqrt{A_1^2 + A_2^2 + 2A_1A_2\cos(\beta_1 - \beta_2)}$

(b) $\sqrt{A_1^2 + A_2^2 + 2A_1A_2\sin(\beta_1 - \beta_2)}$

(c) $A_1 + A_2$

(d) $|A_1 + A_2|$

18. If the ratio of amplitude of wave is 2 : 1, then the ratio of maximum and minimum intensity is **[MH CET 1999]**

(a) 9 : 1 (b) 1 : 9

(c) 4 : 1 (d) 1 : 4

19. The two interfering waves have intensities in the ratio 9 : 4. The ratio of intensities of maxima and minima in the interference pattern will be **[AMU 2000]**

(a) 1 : 25 (b) 25 : 1
(c) 9 : 4 (d) 4 : 9

20. If the ratio of amplitude of two waves is 4 : 3. Then the ratio of maximum and minimum intensity will be

[MHCET 2000]

(a) 16 : 18 (b) 18 : 16
(c) 49 : 1 (d) 1 : 49

21. Equation of motion in the same direction is given by $y_1 = A\sin(\omega t - kx)$, $y_2 = A\sin(\omega t - kx - \theta)$. The amplitude of the medium particle will be

(a) $2A\cos\frac{\theta}{2}$ (b) $2A\cos\theta$
(c) $\sqrt{2}A\cos\frac{\theta}{2}$ (d) $1.2f, 1.2\lambda$

22. Two waves having the intensities in the ratio of 9 : 1 produce interference. The ratio of maximum to the minimum intensity, is equal to

[CPMT 2001; Pb. PET 2004]

(a) 2 : 1 (b) 4 : 1
(c) 9 : 1 (d) 10 : 8

23. The displacement of the interfering light waves are $y_1 = 4\sin\omega t$ and $y_2 = 3\sin\left(\omega t + \frac{\pi}{2}\right)$. What is the amplitude of the resultant wave

[RPMT 1996; Orissa JEE 2005]

(a) 5 (b) 7
(c) 1 (d) 0

24. 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

[RPMT 1996]

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

25. The amplitude of a wave represented by displacement equation $y = \frac{1}{\sqrt{a}}\sin\omega t \pm \frac{1}{\sqrt{b}}\cos\omega t$ will be

[BVP 2003]

(a) $\frac{a+b}{ab}$ (b) $\frac{\sqrt{a}+\sqrt{b}}{ab}$
(c) $\frac{\sqrt{a}\pm\sqrt{b}}{ab}$ (d) $\sqrt{\frac{a+b}{ab}}$

26. Two waves having equations

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

If in the resultant wave the frequency and amplitude remain equal to those of superimposing waves. Then phase difference between them is **[CBSE PMT 2001]**

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

Beats

[BHU 2003]

1. Two tuning forks when sounded together produced 4 *beats/sec*. The frequency of one fork is 256. The number of beats heard increases when the fork of frequency 256 is loaded with wax. The frequency of the other fork is

[CPMT 1976; MP PMT 1993]

(a) 504 (b) 520
(c) 260 (d) 252

2. Beats are the result of

[CPMT 1971; J & K CET 2002]

(a) Diffraction
(b) Destructive interference
(c) Constructive and destructive interference
(d) Superposition of two waves of nearly equal frequency

3. Two adjacent piano keys are struck simultaneously. The notes emitted by them have frequencies n_1 and n_2. The number of beats heard per second is

[CPMT 1974, 78; CBSE PMT 1993]

(a) $\frac{1}{2}(n_1 - n_2)$ (b) $\frac{1}{2}(n_1 + n_2)$
(c) $n_1 \sim n_2$ (d) $2(n_1 - n_2)$

4. A tuning fork of frequency 100 when sounded together with another tuning fork of unknown frequency produces 2 beats per second. On loading the tuning fork whose frequency is not known and sounded together with a tuning fork of frequency 100 produces one beat, then the frequency of the other tuning fork is

[NCERT 1977]

(a) 102 (b) 98

(c) 99 (d) 101

5. A tuning fork sounded together with a tuning fork of frequency 256 emits two beats. On loading the tuning fork of frequency 256, the number of beats heard are 1 per second. The frequency of tuning fork is

[NCERT 1975, 81; MP PET 1985]

(a) 257 (b) 258
(c) 256 (d) 254

6. 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 2 beats when sounded again. The frequency of *A* is 256. The frequency of *B* will be

[CPMT 1976; RPET 1998]

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

7. The frequencies of two sound sources are 256 *Hz* and 260 *Hz*. At $t = 0$, the intensity of sound is maximum. Then the phase difference at the time $t = 1/16$ *sec* will be

(a) Zero (b) π
(c) $\pi/2$ (d) $\pi/4$

8. Two tuning forks have frequencies 450 *Hz* and 454 *Hz* respectively. On sounding these forks together, the time interval between successive maximum intensities will be

[MP PET 1989; MP PMT 2003]

(a) 1/4 *sec* (b) 1/2 *sec*
(c) 1 *sec* (d) 2 *sec*

9. When a tuning fork of frequency 341 is sounded with another tuning fork, six beats per second are heard. When the second tuning fork is loaded with wax and sounded with the first tuning fork, the number of beats is two per second. The natural frequency of the second tuning fork is

[MP PET 1989]

(a) 334 (b) 339
(c) 343 (d) 347

10. Two tuning forks of frequencies 256 and 258 vibrations/sec are sounded together, then time interval between consecutive maxima heard by the observer is

[MP PET/PMT 1988]

(a) 2 *sec* (b) 0.5 *sec*
(c) 250 *sec* (d) 252 *sec*

11. A tuning fork gives 5 beats with another tuning fork of frequency 100 *Hz*. When the first tuning fork is loaded with wax, then the number of beats remains unchanged, then what will be the frequency of the first tuning fork

[MP PMT 1985]

(a) 95 *Hz* (b) 100 *Hz*
(c) 105 *Hz* (d) 110 *Hz*

12. Tuning fork F_1 has a frequency of 256 *Hz* and it is observed to produce 6 beats/second with another tuning fork F_2. When F_2 is loaded with wax, it still produces 6 beats/second with F_1. The frequency of F_2 before loading was

[MP PET 1990]

(a) 253 *Hz* (b) 262 *Hz*
(c) 250 *Hz* (d) 259 *Hz*

13. A tuning fork and a sonometer wire were sounded together and produce 4 beats per second. When the length of sonometer wire is 95 *cm* or 100 *cm*, the frequency of the tuning fork is **[MP PMT 1990]**

(a) 156 *Hz* (b) 152 *Hz*
(c) 148 *Hz* (d) 160 *Hz*

14. Two tuning forks *A* and *B* vibrating simultaneously produce 5 beats. Frequency of *B* is 512. It is seen that if one arm of *A* is filed, then the number of beats increases. Frequency of A will be **[MP PMT 1991]**

(a) 502 (b) 507
(c) 517 (d) 522

15. The beats are produced by two sound sources of same amplitude and of nearly equal frequencies. The maximum intensity of beats will be ...... that of one source

[CPMT 1999]

(a) Same (b) Double
(c) Four times (d) Eight times

16. Beats are produced by two waves given by $y_1 = a\sin 2000\pi t$ and $y_2 = a\sin 2008\pi t$. The number

of beats heard per second is
[CPMT 1990; DCE 1999]

(a) Zero (b) One
(c) Four (d) Eight

17. 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
[MNR 1979; RPMT 1999]

(a) 508 *Hz* (b) 512 *Hz*
(c) 516 *Hz* (d) 518 *Hz*

18. A tuning fork of frequency 480 *Hz* produces 10 beats per second when sounded with a vibrating sonometer string. What must have been the frequency of the string if a slight increase in tension produces lesser beats per second than before **[NCERT 1984]**

(a) 460 *Hz* (b) 470 *Hz*
(c) 480 *Hz* (d) 490 *Hz*

19. When a tuning fork *A* of unknown frequency is sounded with another tuning fork *B* of frequency 256 *Hz*, then 3 beats per second are observed. After that *A* is loaded with wax and sounded, the again 3 beats per second are observed. The frequency of the tuning fork *A* is
[MP PMT 1994]

(a) 250 *Hz* (b) 253 *Hz*
(c) 259 *Hz* (d) 262 *Hz*

20. A source of sound gives five beats per second when sounded with another source of frequency $100\, s^{-1}$. The second harmonic of the source together with a source of frequency $205\, s^{-1}$ gives five beats per second. What is the frequency of the source
[CBSE PMT 1995]

(a) $105\, s^{-1}$ (b) $205\, s^{-1}$
(c) $95\, s^{-1}$ (d) $100\, s^{-1}$

21. When two sound waves are superimposed, beats are produced when they have
[MP PET 1995; CBSE PMT 1992, 99; DCE 2000; DPMT 2000, 01]

(a) Different amplitudes and phases
(b) Different velocities
(c) Different phases
(d) Different frequencies

22. Two tuning forks *A* and *B* give 4 beats per second. The frequency of *A* is 256 *Hz*. On loading *B* slightly, we get 5 beats in 2 seconds. The frequency of *B* after loading is
[Haryana CEE 1996]

(a) 253.5 *Hz* (b) 258.5 *Hz*
(c) 260 *Hz* (d) 252 *Hz*

23. A tuning fork *A* of frequency 200 *Hz* is sounded with fork *B*, the number of beats per second is 5. By putting some wax on *A*, the number of beats increases to 8. The frequency of fork *B* is
[MP PMT 1996]

(a) 200 *Hz* (b) 195 *Hz*
(c) 192 *Hz* (d) 205 *Hz*

24. Two tuning forks, *A* and *B*, give 4 *beats per second* when sounded together. The frequency of *A* is 320 *Hz*. When some wax is added to *B* and it is sounded with *A*, 4 *beats per second* are again heard. The frequency of *B* is
[MP PMT 1997]

(a) 312 *Hz* (b) 316 *Hz*
(c) 324 *Hz* (d) 328 *Hz*

25. Two tuning forks have frequencies 380 and 384 *Hz* 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
[MP PMT/PET 1998]

(a) $\frac{1}{2}$ *sec* (b) $\frac{1}{4}$ *sec*
(c) $\frac{1}{8}$ *sec* (d) $\frac{1}{16}$ *sec*

26. Beats are produced with the help of two sound waves of amplitudes 3 and 5 *units*. The ratio of maximum to minimum intensity in the beats is
[MP PMT 1999]

(a) 2 : 1 (b) 5 : 3
(c) 4 : 1 (d) 16 : 1

27. Two waves of lengths 50 *cm* and 51 *cm* produced 12 beats per second. The velocity of sound is
[CBSE PMT 1999; Pb. PET 2001; AFMC 2003]

(a) 306 *m/s* (b) 331 *m/s*
(c) 340 *m/s* (d) 360 *m/s*

28. Two waves $y = 0.25\sin 316\,t$ and $y = 0.25\sin 310\,t$ are travelling in same direction. The number of beats produced per second will be
[CPMT 1993; JIPMER 2000]
(a) 6 (b) 3
(c) $3/\pi$ (d) 3π

29. The couple of tuning forks produces 2 beats in the time interval of 0.4 seconds. So the beat frequency is
[CPMT 1996]
(a) 8 *Hz* (b) 5 *Hz*
(c) 2 *Hz* (d) 10 *Hz*

30. An unknown frequency *x* produces 8 beats per seconds with a frequency of 250 *Hz* and 12 beats with 270 *Hz* source, then *x* is
[CPMT 1997; KCET 2000]
(a) 258 *Hz* (b) 242 *Hz*
(c) 262 *Hz* (d) 282 *Hz*

31. Beats are produced by two waves
$y_1 = a\sin 1000\pi t,\ \ y_2 = a\sin 998\pi t$
The number of beats heard/sec is
[KCET 1998]
(a) 0 (b) 2
(c) 1 (d) 4

32. The wavelengths of two waves are 50 and 51 *cm* respectively. If the temperature of the room is 20°*C*, then what will be the number of beats produced per second by these waves, when the speed of sound at 0°*C* is 332 *m/sec*
[UPSEAT 1999]
(a) 14 (b) 10
(c) 24 (d) None of these

33. Maximum number of beats frequency heard by a human being is **[RPMT 2000]**
(a) 10 (b) 4
(c) 20 (d) 6

34. Two sound waves of slightly different frequencies propagating in the same direction produce beats due to
[MP PET 2000]
(a) Interference (b) Diffraction
(c) Polarization (d) Refraction

35. 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*
[MP PMT 2000]
(a) 388 *Hz* (b) 380 *Hz*
(c) 378 *Hz* (d) 390 *Hz*

36. It is possible to hear beats from the two vibrating sources of frequency
(a) 100 *Hz* and 150 *Hz* (b) 20 *Hz* and 25 *Hz*
(c) 400 *Hz* and 500 *Hz* (d) 1000 *Hz* and 1500 *Hz*

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

38. Two sound waves of wavelengths 5*m* and 6*m* formed 30 beats in 3 seconds. The velocity of sound is
[EAMCET 2001]
(a) 300 ms^{-1} (b) 310 ms^{-1}
(c) 320 ms^{-1} (d) 330 ms^{-1}

39. The wavelength of a particle is 99 cm and that of other is 100 cm. Speed of sound is 396 m/s. The number of beats heard is
(a) 4 (b) 5
(c) 1 (d) 8

40. A tuning fork arrangement (pair) produces 4 *beats/sec* with one fork of frequency 288 *cps*. A little wax is placed on the unknown fork and it then produces 2 *beats/sec*. The frequency of the unknown fork is
[KCET 1998; AIEEE 2002]
(a) 286 *cps* (b) 292 *cps*
(c) 294 *cps* (d) 288 *cps*

41. A tuning fork vibrates with 2 beats in 0.04 second. The frequency of the fork is **[AFMC 2003]**
(a) 50 *Hz* (b) 100 *Hz*
(c) 80 *Hz* (d) None of these

42. Two sound sources when sounded simultaneously produce four beats in 0.25 second. the difference in their frequencies must be **[BCECE 2003]**

(a) 4 (b) 8

(c) 16 (d) 1

43. A tuning fork of known frequency 256 *Hz* makes 5 beats per second with the vibrating string of a piano. The beat frequency decreases to 2 beats per second when the tension in the piano string is slightly increased. The frequency of the piano string before increasing the tension was

[AIEEE 2003]

(a) 256 + 5 *Hz* (b) 256 + 2*Hz*

(c) 256 – 2 *Hz* (d) 256 – 5*Hz*

44. When temperature increases, the frequency of a tuning fork

[AIEEE 2002]

(a) Increases

(b) Decreases

(c) Remains same

(d) Increases or decreases depending on the material

45. Two strings *X* and *Y* of a sitar produce a beat frequency 4 *Hz*. When the tension of the string *Y* is slightly increased the beat frequency is found to be 2 *Hz*. If the frequency of *X* is 300 *Hz*, then the original frequency of *Y* was

[UPSEAT 2000]

(a) 296 *Hz* (b) 298 *Hz*

(c) 302 *Hz* (d) 304 *Hz*

46. The frequency of tuning forks *A* and *B* are respectively 3% more and 2% less than the frequency of tuning fork *C*. When *A* and *B* are simultaneously excited, 5 beats per second are produced. Then the frequency of the tuning fork '*A*' (in *Hz*) is **[EAMCET 2001]**

(a) 98 (b) 100

(c) 103 (d) 105

47. When a tuning fork vibrates, the waves produced in the fork are

(a) Longitudinal (b) Transverse

(c) Progressive (d) Stationary

48. Two vibrating tuning forks produce progressive waves given by $Y_1 = 4\sin 500\pi t$ and $Y_2 = 2\sin 506\pi t$. Number of beats produced per minute is

(a) 360 (b) 180

(c) 3 (d) 60

49. When a tuning fork produces sound waves in air, which one of the following is same in the material of tuning fork as well as in air

(a) Wavelength (b) Frequency

(c) Velocity (d) Amplitude

50. 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 **[KCET 2005]**

(a) 10 *Hz* (b) 360 *Hz*

(c) 216 *Hz* (d) 6 *Hz*

51. A sound source of frequency 170 *Hz* is placed near a wall. A man walking from a source towards the wall finds that there is a periodic rise and fall of sound intensity. If the speed of sound in air is 340 *m*/*s* the distance (in *metres*) separating the two adjacent positions of minimum intensity is

[MNR 1992; UPSEAT 2000; CPMT 2002]

(a) 1/2 (b) 1

(c) 3/2 (d) 2

Stationary Waves

1. The distance between the nearest node and antinode in a stationary wave is

[MP PET 1984; CBSE PMT 1993; AFMC 1996; RPET 2002]

(a) λ (b) $\frac{\lambda}{2}$

(c) $\frac{\lambda}{4}$ (d) 2λ

2. In stationary wave **[MP PET 1987; BHU 1995]**

(a) Strain is maximum at nodes

(b) Strain is maximum at antinodes

(c) Strain is minimum at nodes

(d) Amplitude is zero at all the points

3. The phase difference between the two particles situated on both the sides of a node is

[AFMC 2001] **[MP PET 2002]**

(a) 0° (b) 90°

(c) 180° (d) 360°

4. Which of the property makes difference between progressive and stationary waves **[MP PMT 1987]**

(a) Amplitude (b) Frequency

(c) Propagation of energy (d) Phase of the wave

5. Stationary waves are formed when **[NCERT 1983]**

(a) Two waves of equal amplitude and equal frequency travel along the same path in opposite directions

(b) Two waves of equal wavelength and equal amplitude travel along the same path with equal speeds in opposite directions

(c) Two waves of equal wavelength and equal phase travel along the same path with equal speed

(d) Two waves of equal amplitude and equal speed travel along the same path in opposite direction

6. For the stationary wave $y = 4\sin\left(\frac{\pi x}{15}\right)\cos(96\pi t)$, the distance between a node and the next antinode is **[MP PMT 1987]**

(a) 7.5 (b) 15

(c) 22.5 (d) 30

7. 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 cm and t in second. The separation between two adjacent nodes is **[CPMT 1990; MP PET 1999; AMU 1999; DPMT 2004; BHU 2005]**

(a) 1.5 *cm* (b) 3 *cm*

(c) 6 *cm* (d) 4 *cm*

8. The equation $\vec{\phi}(x, t) = \vec{j}\sin\left(\frac{2\pi}{\lambda}vt\right)\cos\left(\frac{2\pi}{\lambda}x\right)$ represents **[MNR 1994]**

(a) Transverse progressive wave

(b) Longitudinal progressive wave

(c) Longitudinal stationary wave

(d) Transverse stationary wave

9. The equation of a stationary wave is $y = 0.8\cos\left(\frac{\pi x}{20}\right)\sin 200\pi t$, where x is in *cm* and t is in *sec*. The separation between consecutive nodes will be **[MP PET 1994]**

(a) 20 *cm* (b) 10 *cm*

(c) 40 *cm* (d) 30 *cm*

10. In a stationary wave, all particles are **[MP PMT 1994]**

(a) At rest at the same time twice in every period of oscillation

(b) At rest at the same time only once in every period of oscillation

(c) Never at rest at the same time

(d) Never at rest at all

11. A wave represented by the given equation $y = a\cos(kx - \omega t)$ is superposed with another wave to form a stationary wave such that the point $x = 0$ is a node. The equation for the other wave is **[IIT 1988; MP PMT 1994, 97; AIIMS 1998; SCRA 1998; MP PET 2001; KCET 2001; AIEEE 2002; UPSEAT 2004]**

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

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

12. At a certain instant a stationary transverse wave is found to have maximum kinetic energy. The appearance of string at that instant is **[AIIMS 1995]**

(a) Sinusoidal shape with amplitude $A/3$

(b) Sinusoidal shape with amplitude $A/2$

(c) Sinusoidal shape with amplitude A

(d) Straight line

13. The equation $y = 0.15\sin 5x\cos 300t$, describes a stationary wave. The wavelength of the stationary wave is **[MP PMT 1995]**

(a) Zero (b) 1.256 *metres*

(c) 2.512 *metres* (d) 0.628 *metre*

14. In stationary waves, antinodes are the points where there is **[MP PMT 1996]**

(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

15. In stationary waves all particles between two nodes pass through the mean position

[MP PMT 1999; KCET 2001]

(a) At different times with different velocities

(b) At different times with the same velocity

(c) At the same time with equal velocity

(d) At the same time with different velocities

16. Standing waves can be produced

[IIT-JEE 1999]

(a) On a string clamped at both the ends

(b) On a string clamped at one end and free at the other

(c) When incident wave gets reflected from a wall

(d) When two identical waves with a phase difference of π are moving in the same direction

17. A standing wave having 3 nodes and 2 antinodes is formed between two atoms having a distance 1.21 $\mathring{A}$ between them. The wavelength of the standing wave is

[CBSE PMT 1998; MH CET 2002; AIIMS 2000; BHU 2001]

(a) 1.21 $\mathring{A}$ (b) 2.42 $\mathring{A}$

(c) 6.05 $\mathring{A}$ (d) 3.63 $\mathring{A}$

18. In stationary waves, distance between a node and its nearest antinode is 20 *cm*. The phase difference between two particles having a separation of 60 *cm* will be

[CMEET Bihar 1995]

(a) Zero (b) $\pi/2$

(c) π (d) $3\pi/2$

19. Stationary waves of frequency 300 *Hz* are formed in a medium in which the velocity of sound is 1200 *metre/sec*. The distance between a node and the neighbouring antinode is

[SCRA 1994]

(a) 1 *m* (b) 2 *m*

(c) 3 *m* (d) 4 *m*

20. Which two of the given transverse waves will give stationary waves when get superimposed

[RPET 1997; MP PET 1993]

$z_1 = a\cos(kx - \omega t)$ .....(A)

$z_2 = a\cos(kx + \omega t)$ .....(B)

$z_3 = a\cos(ky - \omega t)$ .....(C)

(a) A and B (b) A and C

(c) B and C (d) Any two

21. A standing wave is represented by

$$Y = A\sin(100t)\cos(0.01x)$$

where *Y* and *A* are in *millimetre*, *t* is in seconds and *x* is in *metre*. The velocity of wave is

[CBSE PMT 1994; AFMC 2002]

(a) $10^4\ m/s$

(b) $1\ m/s$

(c) $10^{-4}\ m/s$

(d) Not derivable from above data

22. 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 are

[CBSE PMT 1994]

(a) 40 *m/s* (b) 20 *m/s*

(c) 10 *m/s* (d) 5 *m/s*

23. $y = a\cos(kx + \omega t)$ superimposes on another wave giving a stationary wave having node at *x* = 0. What is the equation of the other wave

[BHU 1998; DPMT 2000]

(a) $-a\cos(kx + \omega t)$ (b) $a\cos(kx - \omega t)$

(c) $-a\cos(kx - \omega t)$ (d) $-a\sin(kx + \omega t)$

24. Two waves are approaching each other with a velocity of 20 *m/s* and frequency n. The distance between two consecutive nodes is

(a) $\frac{20}{n}$ (b) $\frac{10}{n}$

(c) $\frac{5}{n}$ (d) $\frac{n}{10}$

25. Energy is not carried by which of the following waves

[RPMT 1998; AIIMS 1998, 99]

(a) Stationary (b) Progressive
(c) Transverse (d) Electromagnetic

26. The stationary wave produced on a string is represented by the equation $y = 5\cos(\pi x/3)\sin 40\pi t$. Where x and y are in *cm* and t is in seconds. The distance between consecutive nodes is **[MP PMT 2000]**
(a) 5 *cm* (b) π cm
(c) 3 *cm* (d) 40 *cm*

27. Two sinusoidal waves with same wavelengths and amplitudes travel in opposite directions along a string with a speed 10 ms^{-1}. If the minimum time interval between two instants when the string is flat is 0.5 *s*, the wavelength of the waves is **[Roorkee 2000]**
(a) 25 *m* (b) 20 *m*
(c) 15 *m* (d) 10 *m*

28. "Stationary waves" are so called because in them **[MP PMT 2001]**
(a) The particles of the medium are not disturbed at all
(b) The particles of the medium do not execute SHM
(c) There occurs no flow of energy along the wave
(d) The interference effect can't be observed

29. Two waves are approaching each other with a velocity of 16 *m/s* and frequency *n*. The distance between two consecutive nodes is **[CPMT 2001; Pb. PMT 1999]**
(a) $\frac{16}{n}$ (b) $\frac{8}{n}$
(c) $\frac{n}{16}$ (d) $\frac{n}{8}$

30. Stationary waves **[Kerala (Med.) 2002]**
(a) Transport energy
(b) Does not transport energy
(c) Have nodes and antinodes
(d) Both (b) and (c)

31. In a stationary wave all the particles **[KCET 2002]**
(a) On either side of a node vibrate in same phase
(b) In the region between two nodes vibrate in same phase
(c) In the region between two antinodes vibrate in same phase
(d) Of the medium vibrate in same phase

32. When a stationary wave is formed then its frequency is **[Kerala (Engg.) 2002]**
(a) Same as that of the individual waves
(b) Twice that of the individual waves
(c) Half that of the individual waves
(d) None of the above

33. In stationary waves **[RPMT 1998; JIPMER 2002]**
(a) Energy is uniformly distributed
(b) Energy is minimum at nodes and maximum at antinodes
(c) Energy is maximum at nodes and minimum at antinodes
(d) Alternating maximum and minimum energy producing at nodes and antinodes

34. Equation of a stationary wave is $y = 10\sin\frac{\pi x}{4}\cos 20\pi t$. Distance between two consecutive nodes is **[MP PMT 2002]**
(a) 4 (b) 2
(c) 1 (d) 8

35. At nodes in stationary waves **[SCRA 1994; UPSEAT 2000; MP PET 2003; RPET 2003]**
(a) Change in pressure and density are maximum
(b) Change in pressure and density are minimum
(c) Strain is zero
(d) Energy is minimum

36. Consider the three waves z_1, z_2 and z_3 as
$z_1 = A\sin(kx - \omega t)$, $z_2 = A\sin(kx + \omega t)$
and $z_3 = A\sin(ky - \omega t)$. Which of the following represents a standing wave **[DCE 2004]**
(a) $z_1 + z_2$ (b) $z_2 + z_3$
(c) $z_3 + z_1$ (d) $z_1 + z_2 + z_3$

37. The following equations represent progressive transverse waves $Z_1 = A\cos(\omega t - kx)$, $Z_2 = A\cos(\omega t + kx)$, $Z_3 = A\cos(\omega t + ky)$ and $Z_4 = A\cos(2\omega t - 2ky)$. A stationary wave will be formed by superposing **[MP PET 1993]**
(a) Z_1 and Z_2 (b) Z_1 and Z_4

(c) Z_2 and Z_3 (d) Z_3 and Z_4

38. Two travelling waves $y_1 = A\sin[k(x - ct)]$ and $y_2 = A\sin[k(x + ct)]$ are superimposed on string. The distance between adjacent nodes is **[IIT 1992]**

(a) ct/π (b) $ct/2\pi$

(c) $\pi/2k$ (d) π/k

39. A string vibrates according to the equation $y = 5\sin\left(\frac{2\pi x}{3}\right)\cos 20\pi t$, where *x* and *y* are in *cm* and *t* in *sec*. The distance between two adjacent nodes is

[UPSEAT 2005]

(a) 3 *cm* (b) 4.5 *cm*

(c) 6 *cm* (d) 1.5 *cm*

Vibration of String

1. A string fixed at both the ends is vibrating in two segments. The wavelength of the corresponding wave is

[SCRA 1994]

(a) $\frac{l}{4}$ (b) $\frac{l}{2}$

(c) *l* (d) 2*l*

2. A 1 *cm* long string vibrates with fundamental frequency of 256 *Hz*. If the length is reduced to $\frac{1}{4}cm$ keeping the tension unaltered, the new fundamental frequency will be

[BHU 1997]

(a) 64 (b) 256

(c) 512 (d) 1024

3. 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

[CBSE PMT 1997; AIIMS 1998; JIPMER 2000]

(a) 2 *Hz* (b) 4 *Hz*

(c) 5 *Hz* (d) 10 *Hz*

4. The velocity of waves in a string fixed at both ends is 2 *m/s*. The string forms standing waves with nodes 5.0 *cm* apart. The frequency of vibration of the string in *Hz* is

[SCRA 1998]

(a) 40 (b) 30

(c) 20 (d) 10

5. Which of the following is the example of transverse wave

[CPMT 1999]

(a) Sound waves

(b) Compressional waves in a spring

(c) Vibration of string

(d) All of these

6. A stretched string of 1*m* length and mass $5\times10^{-4}kg$ is having tension of 20*N*. If it is plucked at 25*cm* from one end then it will vibrate with frequency

[RPET 1999; RPMT 2002]

(a) 100 *Hz* (b) 200 *Hz*

(c) 256 *Hz* (d) 400 *Hz*

7. Two similar sonometer wires given fundamental frequencies of 500*Hz*. These have same tensions. By what amount the tension be increased in one wire so that the two wires produce 5 *beats/sec* **[RPET 1999]**

(a) 1% (b) 2%

(c) 3% (d) 4%

8. A string is producing transverse vibration whose equation is $y = 0.021\sin(x + 30t)$, Where *x* and *y* are in meters and t is in seconds. If the linear density of the string is 1.3×10^{-4} *kg/m*, then the tension in the string in N will be

[RPET 1999; RPMT 2002]

(a) 10 (b) 0.5

(c) 1 (d) 0.117

9. If the tension of sonometer's wire increases four times then the fundamental frequency of the wire will increase by

[RPMT 1999]

(a) 2 times (b) 4 times

(c) 1/2 times (d) None of the above

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

[AIIMS 1999; Pb. PET 2000]

(a) Half (b) Twice

(c) Four times (d) Eight times

11. Four wires of identical length, diameters and of the same material are stretched on a sonometre wire. If the ratio of their tensions is 1 : 4 : 9 : 16 then the ratio of their fundamental frequencies are **[KCET 2000]**

(a) 16 : 9 : 4 : 1 (b) 4 : 3 : 2 : 1
(c) 1 : 4 : 2 : 16 (d) 1 : 2 : 3 : 4

12. A tuning fork vibrating with a sonometer having 20 *cm* wire produces 5 beats per second. The beat frequency does not change if the length of the wire is changed to 21 *cm*. the frequency of the tuning fork (in Hertz) must be **[UPSEAT 2000; Pb. PET 2004]**

(a) 200 (b) 210
(c) 205 (d) 215

13. A stretched string of length l, fixed at both ends can sustain stationary waves of wavelength λ, given by **[UPSEAT 2000; Pb. PET 2004; CPMT 2005]**

(a) $\lambda = \frac{n^2}{2l}$ (b) $\lambda = \frac{l^2}{2n}$
(c) $\lambda = \frac{2l}{n}$ (d) $\lambda = 2ln$

14. If you set up the seventh harmonic on a string fixed at both ends, how many nodes and antinodes are set up in it **[AMU 2000]**

(a) 8, 7 (b) 7, 7
(c) 8, 9 (d) 9, 8

15. If you set up the ninth harmonic on a string fixed at both ends, its frequency compared to the seventh harmonic **[AMU (Engg.) 2000]**

(a) Higher (b) Lower
(c) Equal (d) None of the above

16. Frequency of a sonometer wire is *n*. Now its tension is increased 4 times and its length is doubled then new frequency will be **[RPET 2000]**

(a) *n*/2 (b) 4*n*
(c) 2*n* (d) *n*

17. A device used for investigating the vibration of a fixed string or wire is **[BHU 2000]**

(a) Sonometer (b) barometer
(c) Hydrometer (d) None of these

18. A string on a musical instrument is 50 *cm* long and its fundamental frequency is 270 *Hz*. If the desired frequency of 1000 *Hz* is to be produced, the required length of the string is **[EAMCET (Engg.) 1998; CPMT 2000; Pb. PET 2001]**

(a) 13.5 *cm* (b) 2.7 *cm*
(c) 5.4 *cm* (d) 10.3 *cm*

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

(a) 5 *N* (b) 20 *N*
(c) 40 *N* (d) 80 *N*

20. To increase the frequency from 100 *Hz* to 400 *Hz* the tension in the string has to be changed by **[RPET 2001]**

(a) 4 times (b) 16 times
(c) 20 times (d) None of these

21. In order to double the frequency of the fundamental note emitted by a stretched string, the length is reduced to $\frac{3}{4}$*th* of the original length and the tension is changed. The factor by which the tension is to be changed, is **[EAMCET 2001]**

(a) $\frac{3}{8}$ (b) $\frac{2}{3}$
(c) $\frac{8}{9}$ (d) $\frac{9}{4}$

22. A string of 7 *m* length has a mass of 0.035 *kg*. If tension in the string is 60.5 *N*, then speed of a wave on the string is **[CBSE PMT 2001]**

(a) 77 *m/s* (b) 102 *m/s*
(c) 110 *m/s* (d) 165 *m/s*

23. A second harmonic has to be generated in a string of length l stretched between two rigid supports. The point where the string has to be plucked and touched are **[KCET 2001]**

(a) Plucked at $\frac{l}{4}$ and touch at $\frac{l}{2}$
(b) Plucked at $\frac{l}{4}$ and touch at $\frac{3l}{4}$
(c) Plucked at $\frac{l}{2}$ and touched at $\frac{l}{4}$
(d) Plucked at $\frac{l}{2}$ and touched at $\frac{3l}{4}$

24. Transverse waves of same frequency are generated in two steel wires *A* and *B*. The diameter of *A* is twice of *B* and the tension in *A* is half that in *B*. The ratio of velocities of wave in *A* and *B* is **[KCET 2001]**

(a) $1:3\sqrt{2}$ (b) $1:2\sqrt{2}$
(c) $1:2$ (d) $\sqrt{2}:1$

25. A sonometer wire resonates with a given tuning fork forming standing waves with five antinodes between the two bridges when a mass of 9 *kg* is suspended from the wire. When this mass is replaced by a mass *M*, the wire resonates with the same tuning fork forming three antinodes for the same positions of the bridges. The value of *M* is **[IIT-JEE (Screening) 2002]**

(a) 25 *kg* (b) 5 *kg*
(c) 12.5 *kg* (d) 1/25 *kg*

26. The tension of a stretched string is increased by 69%. In order to keep its frequency of vibration constant, its length must be increased by **[KCET 2002]**

(a) 20% (b) 30%
(c) $\sqrt{69}\%$ (d) 69%

27. The length of a sonometer wire tuned to a frequency of 250 *Hz* is 0.60 *metre*. The frequency of tuning fork with which the vibrating wire will be in tune when the length is made 0.40 *metre* is **[JIPMER 2002]**

(a) 250 *Hz* (b) 375 *Hz*
(c) 256 *Hz* (d) 384 *Hz*

28. Length of a string tied to two rigid supports is 40 *cm*. Maximum length (wavelength in *cm*) of a stationary wave produced on it is **[AIEEE 2002]**

(a) 20 (b) 80
(c) 40 (d) 120

29. A string in musical instrument is 50 *cm* long and its fundamental frequency is 800 *Hz*. If a frequency of 1000 *Hz* is to be produced, then required length of string is **[AIIMS 2002]**

(a) 62.5 *cm* (b) 50 *cm*
(c) 40 *cm* (d) 37.5 *cm*

30. Two wires are in unison. If the tension in one of the wires is increased by 2%, 5 beats are produced per second. The initial frequency of each wire is **[MP PET 2002]**

(a) 200 *Hz* (b) 400 *Hz*
(c) 500 *Hz* (d) 1000 *Hz*

31. Two uniform strings *A* and *B* made of steel are made to vibrate under the same tension. if the first overtone of *A* is equal to the second overtone of *B* and if the radius of *A* is twice that of *B*, the ratio of the lengths of the strings is **[EAMCET 2003]**

(a) 1: 2 (b) 1 : 3
(c) 1 : 4 (d) 1 : 6

32. If the length of a stretched string is shortened by 40% and the tension is increased by 44%, then the ratio of the final and initial fundamental frequencies is **[EAMCET 2003]**

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

33. Two wires are fixed in a sonometer. Their tensions are in the ratio 8 : 1. The lengths are in the ratio $36:35$. The diameters are in the ratio 4 : 1. Densities of the materials are in the ratio 1 : 2. If the lower frequency in the setting is 360 *Hz*. the beat frequency when the two wires are sounded together is **[KCET 2003]**

(a) 5 (b) 8
(c) 6 (d) 10

34. The first overtone of a stretched wire of given length is 320 *Hz*. The first harmonic is : **[DPMT 2004]**

(a) 320 *Hz* (b) 160 *Hz*
(c) 480 *Hz* (d) 640 *Hz*

35. Two perfectly identical wires are in unison. When the tension in one wire is increased by 1%, then on sounding them together 3 beats are heard in 2 *sec*. The initial frequency of each wire is : **[Pb. PET 2002]**

(a) $220 s^{-1}$ (b) $320 s^{-1}$
(c) $150 s^{-1}$ (d) $300 s^{-1}$

36. A tuning fork of frequency 392 *Hz*, resonates with 50 *cm* length of a string under tension (*T*). If length of the string is decreased by 2%, keeping the tension constant, the number of beats heard when the string and the tuning fork made to vibrate simultaneously is **[BHU 2004]**

(a) 4 (b) 6
(c) 8 (d) 12

37. The sound carried by air from a sitar to a listener is a wave of the following type **[MP PMT 1987; RPET 2001]**

(a) Longitudinal stationary (b) Transverse progressive

(c) Transverse stationary (d) Longitudinal progressive

38. In Melde's experiment in the transverse mode, the frequency of the tuning fork and the frequency of the waves in the strings are in the ratio **[KCET 2004]**

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

(c) 2 : 1 (d) 4 : 1

39. The frequency of transverse vibrations in a stretched string is 200 *Hz*. If the tension is increased four times and the length is reduced to one-fourth the original value, the frequency of vibration will be **[EAMCET (Med.) 1999]**

(a) 25 *Hz* (b) 200 *Hz*

(c) 400 *Hz* (d) 1600 *Hz*

40. Three similar wires of frequency n_1, n_2 and n_3 are joined to make one wire. Its frequency will be **[CBSE PMT 2000]**

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

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

41. A steel rod 100 *cm* long is clamped at its mid-point. The funda-mental frequency of longitudinal vibrations of the rod is given to be 2.53 *kHz*. What is the speed of sound in steel **[AFMC 2000]**

(a) 5.06 *km/s* (b) 6.06 *km/s*

(c) 7.06 *km/s* (d) 8.06 *km/s*

42. Two wires are producing fundamental notes of the same frequency. Change in which of the following factors of one wire will not produce beats between them **[BHU (Med.) 1999]**

(a) Amplitude of the vibrations

(b) Material of the wire

(c) Stretching force

(d) Diameter of the wires

43. Calculate the frequency of the second harmonic formed on a string of length 0.5 *m* and mass 2×10^{-4} *kg* when stretched with a tension of 20 *N* **[BHU (Med.) 2000]**

(a) 274.4 *Hz* (b) 744.2 *Hz*

(c) 44.72 *Hz* (d) 447.2 *Hz*

44. The fundamental frequency of a string stretched with a weight of 4 *kg* is 256 *Hz*. The weight required to produce its octave is **[J & K CET 2000]**

(a) 4 *kg wt* (b) 8 *kg wt*

(c) 12 *kg wt* (d) 16 *kg wt*

45. Two vibrating strings of the same material but lengths L and $2L$ have radii $2r$ and r respectively. They are stretched under the same tension. Both the strings vibrate in their fundamental modes, the one of length L with frequency n_1 and the other with frequency n_2. The ratio n_1/n_2 is given by **[IIT-JEE (Screening) 2000]**

(a) 2 (b) 4

(c) 8 (d) 1

46. If the tension and diameter of a sonometer wire of fundamental frequency n are doubled and density is halved then its fundamental frequency will become **[CBSE PMT 2001]**

(a) $\frac{n}{4}$ (b) $\sqrt{2}\,n$

(c) n (d) $\frac{n}{\sqrt{2}}$

47. In a sonometer wire, the tension is maintained by suspending a 50.7 *kg* mass from the free end of the wire. The suspended mass has a volume of 0.0075 m^3. The fundamental frequency of the wire is 260 *Hz*. If the suspended mass is completely submerged in water, the fundamental frequency will become (take $g = 10\ ms^{-2}$) **[KCET 2001]**

(a) 240 *Hz* (b) 230 *Hz*

(c) 220 *Hz* (d) 200 *Hz*

48. A string is rigidly tied at two ends and its equation of vibration is given by

$y = \cos 2\pi t \sin \sin \pi x$. Then minimum length of string is **[RPMT 2001]**

(a) 1 *m* (b) $\frac{1}{2}m$

(c) 5 *m* (d) $2\pi m$

49. Fundamental frequency of sonometer wire is *n*. If the length, tension and diameter of wire are tripled, the new fundamental frequency is **[DPMT 2002]**

(a) $\frac{n}{\sqrt{3}}$ (b) $\frac{n}{3}$

(c) $n\sqrt{3}$ (d) $\frac{n}{3\sqrt{3}}$

50. A string of length 2 *m* is fixed at both ends. If this string vibrates in its fourth normal mode with a frequency of 500 *Hz* then the waves would travel on its with a velocity of **[BCECE 2005]**

(a) 125 *m/s* (b) 250 *m/s*

(c) 500 *m/s* (d) 1000 *m/s*

51. The fundamental frequency of a sonometre wire is *n*. If its radius is doubled and its tension becomes half, the material of the wire remains same, the new fundamental frequency will be **[BCECE 2005]**

(a) *n* (b) $\frac{n}{\sqrt{2}}$

(c) $\frac{n}{2}$ (d) $\frac{n}{2\sqrt{2}}$

52. In an experiment with sonometer a tuning fork of frequency 256 *Hz* resonates with a length of 25 *cm* and another tuning fork resonates with a length of 16 *cm*. Tension of the string remaining constant the frequency of the second tuning fork is **[KCET 2005]**

(a) 163.84 *Hz* (b) 400 *Hz*

(c) 320 *Hz* (d) 204.8 *Hz*

Organ Pipe (Vibration of Air Column)

1. The length of two open organ pipes are *l* and $(l+\Delta l)$ respectively. Neglecting end correction, the frequency of beats between them will be approximately **[MP PET 1994; BHU 1995]**

(a) $\frac{v}{2l}$ (b) $\frac{v}{4l}$

(c) $\frac{v\Delta l}{2l^2}$ (d) $\frac{v\Delta l}{l}$

(Here *v* is the speed of sound)

2. A tube closed at one end and containing air is excited. It produces the fundamental note of frequency 512 *Hz*. If the same tube is open at both the ends the fundamental frequency that can be produced is **[RPET 1999]**

(a) 1024 *Hz* (b) 512 *Hz*

(c) 256 *Hz* (d) 128 *Hz*

3. A closed pipe and an open pipe have their first overtones identical in frequency. Their lengths are in the ratio **[Roorkee 1999]**

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

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

4. The first overtone in a closed pipe has a frequency **[JIPMER 1999]**

(a) Same as the fundamental frequency of an open tube of same length

(b) Twice the fundamental frequency of an open tube of same length

(c) Same as that of the first overtone of an open tube of same length

(d) None of the above

5. An empty vessel is partially filled with water, then the frequency of vibration of air column in the vessel **[KCET 2000]**

(a) Remains same

(b) Decreases

(c) Increases

(d) First increases then decreases

6. It is desired to increase the fundamental resonance frequency in a tube which is closed at one end. This can be achieved by

(a) Replacing the air in the tube by hydrogen gas

(b) Increasing the length of the tube

(c) Decreasing the length of the tube

(d) Opening the closed end of the tube

7. An air column in a pipe, which is closed at one end, will be in resonance with a vibrating body of frequency 166 *Hz*, if the length of the air column is **[UPSEAT 2001]**

(a) 2.00 *m* (b) 1.50 *m*

(c) 1.00 *m* (d) 0.50 *m*

8. If the velocity of sound in air is 350 *m/s*. Then the fundamental frequency of an open organ pipe of length 50 *cm*, will be **[CPMT 1997; MH CET 2001; Pb. PMT 2001]**

(a) 350 *Hz* (b) 175 *Hz*

(c) 900 *Hz* (d) 750 *Hz*

9. If the length of a closed organ pipe is 1m and velocity of sound is 330 *m/s*, then the frequency for the second note is **[AFMC 2001]**

(a) $4\times\frac{330}{4}Hz$ (b) $3\times\frac{330}{4}Hz$

(c) $2\times\frac{330}{4}Hz$ (d) $2\times\frac{4}{330}Hz$

10. The fundamental note produced by a closed organ pipe is of frequency f. The fundamental note produced by an open organ pipe of same length will be of frequency **[BHU 2001]**

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

(c) $2f$ (d) $4f$

11. If the velocity of sound in air is 336 m/s. The *maximum* length of a closed pipe that would produce a just audible sound will be **[KCET 2001]**

(a) 3.2 *cm* (b) 4.2 *m*

(c) 4.2 *cm* (d) 3.2 *m*

12. An organ pipe P_1 closed at one end vibrating in its first overtone and another pipe P_2 open at both ends vibrating in its third overtone are in resonance with a given tuning fork. The ratio of lengths of P_1 and P_2 is **[EAMCET 1997; MH CET 1999; AFMC 2001]**

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

(c) 3 : 8 (d) 3 : 4

13. A resonance air column of length 20 *cm* resonates with a tuning fork of frequency 250 *Hz*. The speed of sound in air is **[AFMC 1999; BHU 2000; CPMT 2001]**

(a) 300 *m/s* (b) 200 *m/s*

(c) 150 *m/s* (d) 75 *m/s*

14. A cylindrical tube, open at both ends, has a fundamental frequency f_0 in air. The tube is dipped vertically into water such that half of its length is inside water. The fundamental frequency of the air column now is **[RPET 1999; RPMT 1998, 2000; J & K CET 2000; KCET 2002; BHU 2002; BCECE 2003]**

(a) $3f_0/4$ (b) f_0

(c) $f_0/2$ (d) $2f_0$

15. If the length of a closed organ pipe is 1.5 *m* and velocity of sound is 330 *m/s*, then the frequency for the second note is **[CBSE PMT 2002]**

(a) 220 *Hz* (b) 165 *Hz*

(c) 110 *Hz* (d) 55 *Hz*

16. A pipe 30 *cm* long is open at both ends. Which harmonic mode of the pipe is resonantly excited by a 1.1 *kHz* source ? (Take speed of sound in air = 330 ms^{-1}) **[AMU 2002]**

(a) First (b) Second

(c) Third (d) Fourth

17. Two closed organ pipes, when sounded simultaneously gave 4 beats per sec. If longer pipe has a length of 1*m*. Then length of shorter pipe will be, (v = 300 *m/s*) **[Pb. PMT 2002]**

(a) 185.5 *cm* (b) 94.9 *cm*

(c) 90 *cm* (d) 80 *cm*

18. A source of sound placed at the open end of a resonance column sends an acoustic wave of pressure amplitude ρ_0 inside the tube. If the atmospheric pressure is ρ_A, then the ratio of maximum and minimum pressure at the closed end of the tube will be **[UPSEAT 2002]**

(a) $\frac{(\rho_A+\rho_0)}{(\rho_A-\rho_0)}$ (b) $\frac{(\rho_A+2\rho_0)}{(\rho_A-2\rho_0)}$

(c) $\frac{\rho_A}{\rho_A}$ (d) $\frac{\left(\rho_A+\frac{1}{2}\rho_0\right)}{\left(\rho_A-\frac{1}{2}\rho_0\right)}$

19. Two closed pipe produce 10 beats per second when emitting their fundamental nodes. If their length are in ratio of 25 : 26. Then their fundamental frequency in *Hz*, are **[MH CET 2002]**

(a) 270, 280 (b) 260, 270

(c) 260, 250 (d) 260, 280

20. A closed organ pipe and an open organ pipe are tuned to the same fundamental frequency. What is the ratio of lengths **[BHU 2003; Kerala 2005]**

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

21. An open pipe resonates with a tuning fork of frequency 500 *Hz*. it is observed that two successive nodes are formed at distances 16 and 46 *cm* from the open end. The speed of sound in air in the pipe is **[Orissa JEE 2003]**

(a) 230 *m/s* (b) 300 *m/s*
(c) 320 *m/s* (d) 360 *m/s*

22. Find the fundamental frequency of a closed pipe, if the length of the air column is 42 *m*. (speed of sound in air = 332 *m/sec*)

(a) 2 *Hz* (b) 4 *Hz*
(c) 7 *Hz* (d) 9 *Hz*

23. If v is the speed of sound in air then the shortest length of the closed pipe which resonates to a frequency n

[KCET 2003]

(a) $\frac{v}{4n}$ (b) $\frac{v}{2n}$
(c) $\frac{2n}{v}$ (d) $\frac{4n}{v}$

24. The frequency of fundamental tone in an open organ pipe of length 0.48 *m is* 320 *Hz.* Speed of sound is 320 *m/sec*. Frequency of fundamental tone in closed organ pipe will be
[MP PMT 2003]

(a) 153.8 *Hz* (b) 160.0 *Hz*
(c) 320.0 *Hz* (d) 143.2 *Hz*

25. If fundamental frequency of closed pipe is 50 *Hz* then frequency of 2^{nd} overtone is
[AFMC 2004]

(a) 100 *Hz* (b) 50 *Hz*
(c) 250 *Hz* (d) 150 *Hz*

26. Two open organ pipes of length 25 *cm* and 25.5 *cm* produce 10 *beat/sec*. The velocity of sound will be

[Pb. PMT 2004]

(a) 255 *m/s* (b) 250 *m/s*
(c) 350 *m/s* (d) None of these

27. What is minimum length of a tube, open at both ends, that resonates with tuning fork of frequency 350 *Hz* ? [velocity of sound in air = 350 *m/s*] **[DPMT 2004]**

(a) 50 *cm* (b) 100 *cm*
(c) 75 *cm* (d) 25 *cm*

28. Two open organ pipes give 4 *beats/sec* when sounded together in their fundamental nodes. If the length of the pipe are 100 *cm* and 102.5 *cm* respectively, then the velocity of sound is :
[Pb. PET 2000; CPMT 2001]

(a) 496 *m/s* (b) 328 *m/s*
(c) 240 *m/s* (d) 160 *m/s*

29. The harmonics which are present in a pipe open at one end are **[UPSEAT 2000; MHCET 2004]**

(a) Odd harmonics
(b) Even harmonics
(c) Even as well as odd harmonics
(c) None of these **[RPET 2003]**

30. An open pipe is suddenly closed at one end with the result that the frequency of third harmonic of the closed pipe is found to be higher by 100 *Hz*, then the fundamental frequency of open pipe is:**[UPSEAT 2001; Pb. PET 2004]**

(a) 480 *Hz* (b) 300 *Hz*
(c) 240 *Hz* (d) 200 *Hz*

31. Tube *A* has both ends open while tube *B* has one end closed, otherwise they are identical. The ratio of fundamental frequency of tube *A* and *B* is

[AIEEE 2002; CPMT 2004]

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

32. If the temperature increases, then what happens to the frequency of the sound produced by the organ pipe

[RPET 1996; DPMT 2000; RPMT 2001]

(a) Increases (b) Decreases
(c) Unchanged (d) Not definite

33. Apparatus used to find out the velocity of sound in gas is

[AFMC 2004]

(a) Melde's apparatus (b) Kundt's tube
(c) Quincke's tube (d) None of these

34. Standing stationary waves can be obtained in an air column even if the interfering waves are
[CPMT 1972]

(a) Of different pitches
(b) Of different amplitudes
(c) Of different qualities

(d) Moving with different velocities

35. The stationary wave $y = 2a\sin kx\cos\omega t$ in a closed organ pipe is the result of the superposition of $y = a\sin(\omega t - kx)$ and

[Roorkee 1994]

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

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

36. Stationary waves are set up in air column. Velocity of sound in air is 330 *m/s* and frequency is 165 *Hz*. Then distance between the nodes is

[EAMCET (Engg.) 1995; CPMT 1999]

(a) 2 *m* (b) 1 *m*

(c) 0.5 *m* (d) 4 *m*

37. An open pipe of length *l* vibrates in fundamental mode. The pressure variation is maximum at

[EAMCET (Med.) 1999]

(a) 1/4 from ends

(b) The middle of pipe

(c) The ends of pipe

(d) At 1/8 from ends of pipe middle of the pipe

38. Fundamental frequency of pipe is 100 *Hz* and other two frequencies are 300 *Hz* and 500 *Hz* then

[RPMT 1998, 2003; CPMT 2001]

(a) Pipe is open at both the ends

(b) Pipe is closed at both the ends

(c) One end open and another end is closed

(d) None of the above

39. Fundamental frequency of an open pipe of length 0.5 *m* is equal to the frequency of the first overtone of a closed pipe of length *l*. The value of l_c is (*m*) **[KCET 1999]**

(a) 1.5 (b) 0.75

(c) 2 (d) 1

40. In a closed organ pipe the frequency of fundamental note is 50 *Hz*. The note of which of the following frequencies will not be emitted by it **[J & K CET 2000]**

(a) 50 *Hz* (b) 100 *Hz*

(c) 150 *Hz* (d) None of the above

41. On producing the waves of frequency 1000 *Hz* in a Kundt's tube, the total distance between 6 successive nodes is 85 *cm*. Speed of sound in the gas filled in the tube is

[AFMC 1999]

(a) 330 *m/s* (b) 340 *m/s*

(c) 350 *m/s* (d) 300 *m/s*

42. What is the base frequency if a pipe gives notes of frequencies 425, 255 and 595 and decide whether it is closed at one end or open at both ends **[UPSEAT 2001]**

(a) 17, closed (b) 85, closed

(c) 17, open (d) 85, open

43. A student determines the velocity of sound with the help of a closed organ pipe. If the observed length for fundamental frequency is 24.7 *m*, the length for third harmonic will be

[RPET 2002]

(a) 74.1 *cm* (b) 72.7 *cm*

(c) 75.4 *cm* (d) 73.1 *cm*

44. An open pipe of length 33 *cm* resonates with frequency of 100 *Hz*. If the speed of sound is 330 *m/s*, then this frequency is

[RPMT 2002]

(a) Fundamental frequency of the pipe

(b) Third harmonic of the pipe

(c) Second harmonic of the pipe

(d) Fourth harmonic of the pipe

45. In a resonance tube the first resonance with a tuning fork occurs at 16 *cm* and second at 49 *cm*. If the velocity of sound is 330 *m/s*, the frequency of tuning fork is

[DPMT 2002]

(a) 500 (b) 300

(c) 330 (d) 165

46. Two closed organ pipes of length 100 *cm* and 101 *cm* 16 beats in 20 *sec*. When each pipe is sounded in its fundamental mode calculate the velocity of sound

[AFMC 2003]

(a) 303 ms^{-1} (b) 332 ms^{-1}

(c) 323.2 ms^{-1} (d) 300 ms^{-1}

47. In open organ pipe, if fundamental frequency is *n* then the other frequencies are

[BCECE 2005]

(a) *n*, 2*n*, 3*n*, 4*n* (b) *n*, 3*n*, 5*n*

(c) *n*, 2*n*, 4*n*, 8*n* (d) None of these

48. If in an experiment for determination of velocity of sound by resonance tube method using a tuning fork of 512 *Hz*, first resonance was observed at 30.7 *cm* and second was obtained at 63.2 *cm*, then maximum possible error in velocity of sound is (consider actual speed of sound in air is 332 *m/s*)

[IIT-JEE (Screening) 2005]

(a) 204 *cm/sec* (b) 110 *cm/sec*

(c) 58 *cm/sec* (d) 80 *cm/sec*

49. An organ pipe, open from both end produces 5 beats per second when vibrated with a source of frequency 200 *Hz*. The second harmonic of the same pipes produces 10 beats per second with a source of frequency 420 *Hz*. The frequency of source is **[DCE 2005]**

(a) 195 *Hz* (b) 205 *Hz*

(c) 190 *Hz* (d) 210 *Hz*

50. In one metre long open pipe what is the harmonic of resonance obtained with a tuning fork of frequency 480 *Hz*

[J & K CET 2005]

(a) First (b) Second

(c) Third (d) Fourth

51. An organ pipe open at one end is vibrating in first overtone and is in resonance with another pipe open at both ends and vibrating in third harmonic. The ratio of length of two pipes is

[DCE 2005]

(a) 1 : 2 (b) 4 : 1

(c) 8 : 3 (d) 3 : 8

52. In a resonance pipe the first and second resonances are obtained at depths 22.7 *cm* and 70.2 *cm* respectively. What will be the end correction **[J & K CET 2005]**

(a) 1.05 *cm* (b) 115.5 *cm*

(c) 92.5 *cm* (d) 113.5 *cm*

53. An open tube is in resonance with string (frequency of vibration of tube is n_0). If tube is dipped in water so that 75% of length of tube is inside water, then the ratio of the frequency of tube to string now will be **[J & K CET 2005]**

(a) 1 (b) 2

(c) $\frac{2}{3}$ (d) $\frac{3}{2}$

Doppler's Effect

1. Doppler shift in frequency does not depend upon

[MP PMT 1993; DPMT 2000]

(a) The frequency of the wave produced

(b) The velocity of the source

(c) The velocity of the observer

(d) Distance from the source to the listener

2. A source of sound of frequency 450 *cycles/sec* is moving towards a stationary observer with 34 *m/sec* speed. If the speed of sound is 340 *m/sec*, then the apparent frequency will be

[MP PMT 1987]

(a) 410 *cycles/sec* (b) 500 *cycles/sec*

(c) 550 *cycles/sec* (d) 450 *cycles/sec*

3. The wavelength is 120 *cm* when the source is stationary. If the source is moving with relative velocity of 60 *m/sec* towards the observer, then the wavelength of the sound wave reaching to the observer will be (velocity of sound = 330 *m/s*)

(a) 98 *cm* (b) 140 *cm*

(c) 120 *cm* (d) 144 *cm*

4. The frequency of a whistle of an engine is 600 *cycles/sec* is moving with the speed of 30 *m/sec* towards an observer. The apparent frequency will be (velocity of sound = 330 *m/s*)

[MP PMT 1989]

(a) 600 *cps* (b) 660 *cps*

(c) 990 *cps* (d) 330 *cps*

5. A source of sound emits waves with frequency *f Hz* and speed *V m/sec*. Two observers move away from this source in opposite directions each with a speed 0.2 V relative to the source. The ratio of frequencies heard by the two observers will be **[MP PET 1990]**

(a) 3 : 2 (b) 2 : 3
(c) 1 : 1 (d) 4 : 10

6. The source producing sound and an observer both are moving along the direction of propagation of sound waves. If the respective velocities of sound, source and an observer are v, v_s and v_o, then the apparent frequency heard by the observer will be (n = frequency of sound) **[MP PMT 1989]**

(a) $\frac{n(v+v_o)}{v-v_o}$ (b) $\frac{n(v-v_o)}{v-v_s}$
(c) $\frac{n(v-v_o)}{v+v_s}$ (d) $\frac{n(v+v_o)}{v+v_s}$

7. An observer moves towards a stationary source of sound of frequency n. The apparent frequency heard by him is $2n$. If the velocity of sound in air is 332 m/sec, then the velocity of the observer is **[MP PET 1990]**

(a) 166 *m*/*sec* (b) 664 *m*/*sec*
(c) 332 *m*/*sec* (d) 1328 *m*/*sec*

8. An observer is moving towards the stationary source of sound, then **[MH CET 2001]**

(a) Apparent frequency will be less than the real frequency
(b) Apparent frequency will be greater than the real frequency
(c) Apparent frequency will be equal to real frequency
(d) Only the quality of sound will change

9. A whistle sends out 256 waves in a second. If the whistle approaches the observer with velocity 1/3 of the velocity of sound in air, the number of waves per second the observer will receive **[MP PET 1990; DPMT 2002]**

(a) 384 (b) 192
(c) 300 (d) 200

10. A person feels 2.5% difference of frequency of a motor-car horn. If the motor-car is moving to the person and the velocity of sound is 320 *m*/*sec*, then the velocity of car will be **[CPMT 1981; MP PET 1989]**

(a) 8 *m*/*s* (approx.) (b) 800 *m*/*s*
(c) 7 *m*/*s* (d) 6 *m*/*s* (approx.)

11. Two passenger trains moving with a speed of 108 *km*/*hour* cross each other. One of them blows a whistle whose frequency is 750 *Hz*. If sound speed is 330 *m*/*s*, then passengers sitting in the other train, after trains cross each other will hear sound whose frequency will be **[MP PMT 1991]**

(a) 900 *Hz* (b) 625 *Hz*
(c) 750 *Hz* (d) 800 *Hz*

12. With what velocity an observer should move relative to a stationary source so that he hears a sound of double the frequency of source **[MP PMT 1991]**

(a) Velocity of sound towards the source
(b) Velocity of sound away from the source
(c) Half the velocity of sound towards the source
(d) Double the velocity of sound towards the source

13. A source of sound emitting a note of frequency 200 *Hz* moves towards an observer with a velocity v equal to the velocity of sound. If the observer also moves away from the source with the same velocity v, the apparent frequency heard by the observer is **[MP PMT 1990]**

(a) 50 *Hz* (b) 100 *Hz*
(c) 150 *Hz* (d) 200 *Hz*

14. Doppler's effect will not be applicable when the velocity of sound source is

(a) Equal to that of the sound velocity
(b) Less than the velocity of sound
(c) Greater than the velocity of sound
(d) Zero

15. An observer while going on scooter hears sound of two sirens of same frequencies from two opposite directions. If he travels along the direction of one of the siren, then he

(a) Listens resonance
(b) Listens beats

(c) Will not listen sound due to destructive interference

(d) Will listen intensive sound due to constructive interference

16. A source of sound is travelling towards a stationary observer. The frequency of sound heard by the observer is of three times the original frequency. The velocity of sound is v *m*/*sec*. The speed of source will be

[MP PET 1991]

(a) $\frac{2}{3}v$ (b) v

(c) $\frac{3}{2}v$ (d) $3v$

17. A sound source is moving towards a stationary observer with 1/10 of the speed of sound. The ratio of apparent to real frequency is

[CPMT 1977; NCERT 1977; KCET 2001, 03]

(a) 10/9 (b) 11/10

(c) $(11/10)^2$ (d) $(9/10)^2$

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

[CPMT 1976; RPET 1999; BHU 1997, 2001]

(a) 600 (b) 1050

(c) 1400 (d) 2400

19. Suppose that the speed of sound in air at a given temperature is 400 *m*/*sec*. An engine blows a whistle at 1200 *Hz* frequency. It is approaching an observer at the speed of 100 *m*/*sec*. What is the apparent frequency as heard by the observer **[CPMT 1983; DPMT 2001]**

(a) 600 *Hz* (b) 1200 *Hz*

(c) 1500 *Hz* (d) 1600 *Hz*

20. A source of frequency 150 *Hz* is moving in the direction of a person with a velocity of 110 *m*/*s*. The frequency heard by the person will be (speed of sound in medium = 330 *m*/*s*)

[CPMT 1989; RPET 2001]

(a) 225 *Hz* (b) 200 *Hz*

(c) 150 *Hz* (d) 100 *Hz*

21. The Doppler's effect is applicable for

[AFMC 1998]

(a) Light waves (b) Sound waves

(c) Space waves (d) Both (a) and (b)

22. A source of sound is moving with constant velocity of 20 *m*/*s* emitting a note of frequency 1000 *Hz*. The ratio of frequencies observed by a stationary observer while the source is approaching him and after it crosses him will be

[MP PET 1994]

(a) 9 : 8 (b) 8 : 9

(c) 1 : 1 (d) 9 : 10

(Speed of sound v = 340 *m*/*s*)

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

[MP PMT 1994]

(a) 750 *Hz* (b) 857 *Hz*

(c) 1143 *Hz* (d) 1333 *Hz*

24. 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

[MP PMT 1994; MP PET 2001]

(a) 1.11 f (b) 1.22 f

(c) f (d) 1.27 f

25. A table is revolving on its axis at 5 revolutions per second. A sound source of frequency 1000 *Hz* is fixed on the table at 70 *cm* from the axis. The minimum frequency heard by a listener standing at a distance from the table will be (speed of sound = 352 *m*/*s*)

[MP PET 1996]

(a) 1000 *Hz* (b) 1066 *Hz*

(c) 941 *Hz* (d) 352 *Hz*

26. A source of sound S of frequency 500 *Hz* situated between a stationary observer O and a wall W, moves towards the wall with a speed of 2 *m*/*s*. If the velocity of sound is 332 *m*/*s*, then the number of beats per second heard by the observer is (approximately)

(a) 8 (b) 6

(c) 4 (d) 2

27. A motor car blowing a horn of frequency 124*vib*/*sec* moves with a velocity 72 *km*/*hr* towards a tall wall. The frequency of the reflected sound heard by the driver will be (velocity of sound in air is 330 *m*/*s*)

[MP PET 1997]

(a) 109 *vib*/*sec* (b) 132 *vib*/*sec*

(c) 140 *vib*/*sec* (d) 248 *vib*/*sec*

28. A source of sound of frequency n is moving towards a stationary observer with a speed S. If the speed of sound in air is V and the frequency heard by the observer is n_1, the value of n_1/n is

[MP PMT 1997]

(a) $(V+S)/V$ (b) $V/(V+S)$

(c) $(V-S)/V$ (d) $V/(V-S)$

29. 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*)

[CBSE PMT 1998; AIIMS 2000]

(a) $n_1 = 10n$ (b) $n_1 = 0$

(c) $n_1 = 0.1n$ (d) $n_1 = -0.1n$

30. A whistle giving out 450 *Hz* approaches a stationary observer at a speed of 33 *m*/*s*. The frequency heard by the observer in *Hz* is

[IIT 1997 Cancelled]

(a) 409 (b) 429

(c) 517 (d) 500

31. An observer is moving away from source of sound of frequency 100 *Hz*. His speed is 33 *m*/*s*. If speed of sound is 330 *m*/*s*, then the observed frequency is

[EAMCET (Engg.) 1995; CPMT 1999]

(a) 90 *Hz* (b) 100 *Hz*

(c) 91 *Hz* (d) 110 *Hz*

32. An observer standing at station observes frequency 219 *Hz* when a train approaches and 184 *Hz* when train goes away from him. If velocity of sound in air is 340 *m*/s, then velocity of train and actual frequency of whistle will be

[RPET 1997]

(a) $15.5\,ms^{-1}$, $200\,Hz$ (b) $19.5\,ms^{-1}$, $205\,Hz$

(c) $29.5\,ms^{-1}$, $200\,Hz$ (d) $32.5\,ms^{-1}$, $205\,Hz$

33. At what speed should a source of sound move so that stationary observer finds the apparent frequency equal to half of the original frequency **[RPMT 1996]**

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

(c) $\frac{v}{4}$ (d) v

34. A boy is walking away from a wall towards an observer at a speed of 1 *metre*/*sec* and blows a whistle whose frequency is 680 *Hz*. The number of beats heard by the observer per second is (Velocity of sound in air = 340 *metres*/*sec*

[MP PMT 1995]

(a) Zero (b) 2

(c) 8 (d) 4

35. The driver of a car travelling with speed 30 *metres per second* towards a hill sounds a horn of frequency 600 *Hz*. If the velocity of sound in air is 330 *metres per second*, the frequency of the reflected sound as heard by the driver is

[MP PMT 1996]

(a) 720 *Hz* (b) 555.5 *Hz*

(c) 550 *Hz* (d) 500 *Hz*

36. Two sirens situated one kilometer apart are producing sound of frequency 330 *Hz*. An observer starts moving from one siren to the other with a speed of 2 *m*/*s*. If the speed of sound be 330 *m*/*s*, what will be the beat frequency heard by the observer **[RPMT 1996; CPMT 2002]**

(a) 8 (b) 4

(c) 6 (d) 1

37. A source of sound is travelling with a velocity 40 *km*/*hour* towards observer and emits sound of frequency 2000 *Hz*. If velocity of sound is 1220 *km*/*hour*, then what is the apparent frequency heard by an observer **[AFMC 1997]**

(a) 2210 *Hz* (b) 1920 *Hz*

(c) 2068 *Hz* (d) 2086 *Hz*

38. A source of sound and listener are approaching each other with a speed of 40 *m*/*s*. The apparent frequency of note produced by the source is 400 *cps*. Then, its true frequency (in *cps*) is (velocity of sound in air = 360 *m*/*s*)

[KCET 1999]

(a) 420 (b) 360

(c) 400 (d) 320

39. A siren emitting sound of frequency 500 *Hz* is going away from a static listener with a speed of 50 *m*/*sec*. The frequency of sound to be heard, directly from the siren, is

[AIIMS 1999; Pb. PMT 2003]

(a) 434.2 *Hz* (b) 589.3 *Hz*

(c) 481.2 *Hz* (d) 286.5 *Hz*

40. A man sitting in a moving train hears the whistle of the engine. The frequency of the whistle is 600 *Hz*

[JIPMER 1999]

(a) The apparent frequency as heard by him is smaller than 600 *Hz*

(b) The apparent frequency is larger than 600 *Hz*

(c) The frequency as heard by him is 600 *Hz*

(d) None of the above

41. A source of sound of frequency 500 *Hz* is moving towards an observer with velocity 30 *m/s*. The speed of sound is 330 *m/s*. the frequency heard by the observer will be

[MP PET 2000; Kerala PMT 2005; UPSEAT 2005]

(a) 550 *Hz* (b) 458.3 *Hz*

(c) 530 *Hz* (d) 545.5 *Hz*

42. A source of sound of frequency 90 vibrations/*sec* is approaching a stationary observer with a speed equal to 1/10 the speed of sound. What will be the frequency heard by the observer

(a) 80 vibrations/*sec* (b) 90 vibrations/*sec*

(c) 100 vibrations/*sec* (d) 120 vibrations/*sec*

43. A whistle of frequency 500 *Hz* tied to the end of a string of length 1.2 *m* revolves at 400 *rev*/*min*. A listener standing some distance away in the plane of rotation of whistle hears frequencies in the range (speed of sound = 340 *m*/*s*)

[KCET 2000; AMU 1999; Pb. PET 2003]

(a) 436 to 586 (b) 426 to 574

(c) 426 to 584 (d) 436 to 674

44. A train moves towards a stationary observer with speed 34 *m*/*s*. The train sounds a whistle and its frequency registered by the observer is f_1. If the train's speed is reduced to 17 *m*/*s*, the frequency registered is f_2. If the speed of sound is 340 *m*/*s* then the ratio f_1 / f_2 is

[IIT-JEE (Screening) 2000]

(a) 18/19 (b) 1/2

(c) 2 (d) 19/18

45. If source and observer both are relatively at rest and if speed of sound is increased then frequency heard by observer will

[RPET 2000; J & K CET 2004]

(a) Increases (b) Decreases

(c) Can not be predicted (d) Will not change

46. 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 actual frequency of the source is (velocity of sound in air = 340 *m/s*)

MH CET 2000; AFMC 2000; CBSE PMT 2001]

(a) 1950 *Hz* (b) 2068 *Hz*

(c) 2132 *Hz* (d) 2486 *Hz*

47. A source is moving towards an observer with a speed of 20 *m*/*s* and having frequency of 240

Hz. The observer is now moving towards the source with a speed of 20 *m/s*. Apparent frequency heard by observer, if velocity of sound is 340 *m/s*, is **[CPMT 2000; KCET 2001; MH CET 2004]**

(a) 240 *Hz* (b) 270 *Hz*
(c) 280 *Hz* (d) 360 *Hz*

48. A siren placed at a railway platform is emitting sound of frequency 5 *kHz*. *A* passenger sitting in a moving train *A* records a frequency of 5.5 *kHz* while the train approaches the siren. During his return journey in a different train *B* he records a frequency of 6.0 *kHz* while approaching the same siren. The ratio of the velocity of train *B* to that of train *A* is

[IIT-JEE (Screening) 2002]

(a) 242/252 (b) 2
(c) 5/6 (d) 11/6

49. A whistle revolves in a circle with an angular speed of 20 *rad/sec* using a string of length 50 *cm*. If the frequency of sound from the whistle is 385 *Hz*, then what is the minimum frequency heard by an observer, which is far away from the centre in the same plane ? ($v = 340$ *m/s*)

[CBSE PMT 2002]

(a) 333 *Hz* (b) 374 *Hz*
(c) 385 *Hz* (d) 394 *Hz*

50. A Siren emitting sound of frequency 800 *Hz* is going away from a static listener with a speed of 30 *m/s*, frequency of the sound to be heard by the listener is (take velocity of sound as 330 *m/s*)

[CPMT 1996; AIIMS 2002; Pb. PMT 2001]

(a) 733.3 *Hz* (b) 644.8 *Hz*
(c) 481.2 *Hz* (d) 286.5 *Hz*

51. A car sounding a horn of frequency 1000 *Hz* passes an observer. The ratio of frequencies of the horn noted by the observer before and after passing of the car is 11 : 9. If the speed of sound is *v*, the speed of the car is

[MP PET 2002]

(a) $\frac{1}{10}v$ (b) $\frac{1}{2}v$
(c) $\frac{1}{5}v$ (d) v

52. What should be the velocity of a sound source moving towards a stationary observer so that apparent frequency is double the actual frequency (Velocity of sound is *v*)

[MP PMT 2002]

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

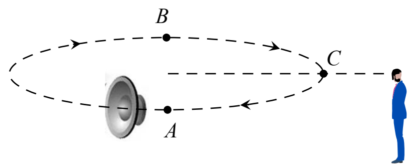
53. Two trains are moving towards each other at speeds of 20 *m/s* and 15 *m/s* relative to the ground. The first train sounds a whistle of frequency 600 *Hz*. the frequency of the whistle heard by a passenger in the second train before the train meets is (the speed of sound in air is 340 *m/s*)

[UPSEAT 2002]

(a) 600 *Hz* (b) 585 *Hz*
(c) 645 *Hz* (d) 666 *Hz*

54. A small source of sound moves on a circle as shown in the figure and an observer is standing on O. Let n_1, n_2 and n_3 be the frequencies heard when the source is at A, B and C respectively. Then **[UPSEAT 2002]**

(a) $n_1 > n_2 > n_3$
(b) $n_2 > n_3 > n_1$
(c) $n_1 = n_2 > n_3$
(d) $n_2 > n_1 > n_3$



55. A source and an observer approach each other with same velocity 50 *m/s*. If the apparent frequency is 435 sec^{-1}, then the real frequency is **[CPMT 2003]**

(a) 320 s^{-1} (b) 360 sec^{-1}
(c) 390 sec^{-1} (d) 420 sec^{-1}

56. A source emits a sound of frequency of 400 *Hz*, but the listener hears it to be 390 *Hz*. Then

[Orissa JEE 2003]

(a) The listener is moving towards the source

(b) The source is moving towards the listener

(c) The listener is moving away from the source

(d) The listener has a defective ear

57. Doppler effect is applicable for [AFMC 2003]

(a) Moving bodies

(b) One is moving and other are stationary

(c) For relative motion

(d) None of these

58. A source and an observer are moving towards each other with a speed equal to $\frac{v}{2}$ where v is the speed of sound. The source is emitting sound of frequency n. The frequency heard by the observer will be **[MP PET 2003]**

(a) Zero (b) n

(c) $\frac{n}{3}$ (d) $3n$

59. When an engine passes near to a stationary observer then its apparent frequencies occurs in the ratio 5/3. If the velocity of engine is [MP PMT 2003]

(a) 540 *m/s* (b) 270 *m/s*

(c) 85 *m/s* (d) 52.5 *m/s*

60. A police car horn emits a sound at a frequency 240 *Hz* when the car is at rest. If the speed of the sound is 330 *m/s*, the frequency heard by an observer who is approaching the car at a speed of 11 *m/s*, is : **[UPSEAT 2004]**

(a) 248 *Hz* (b) 244 *Hz*

(c) 240 *Hz* (d) 230 *Hz*

61. A person carrying a whistle emitting continuously a note of 272 *Hz* is running towards a reflecting surface with a speed of 18 *km/hour*. The speed of sound in air is $345 ms^{-1}$. The number of beats heard by him is

[Kerala (Engg.) 2002]

(a) 4 (b) 6

(c) 8 (d) 3

62. A bus is moving with a velocity of 5 *m/s* towards a huge wall. the driver sounds a horn of frequency 165 *Hz*. If the speed of sound in air is 355 *m/s*, the number of beats heard per second by a passenger on the bus will be

[KCET 2001; BHU 2002]

(a) 6 (b) 5

(c) 3 (d) 4

63. A source of sound of frequency 256 *Hz* is moving rapidly towards a wall with a velocity of 5*m/s*. The speed of sound is 330 *m/s*. If the observer is between the wall and the source, then beats per second heard will be **[UPSEAT 2002]**

(a) 7.8 *Hz* (b) 7.7 *Hz*

(c) 3.9 *Hz* (d) Zero

64. The apparent frequency of a note, when a listener moves towards a stationary source, with velocity of 40 *m/s* is 200 *Hz*. When he moves away from the same source with the same speed, the apparent frequency of the same note is 160 *Hz*. The velocity of sound in air is (in *m/s*) **[KCET 1998]**

(a) 360 (b) 330

(c) 320 (d) 340

65. An observer moves towards a stationary source of sound, with a velocity one-fifth of the velocity of sound. What is the percentage increase in the apparent frequency

[AIEEE 2005]

(a) 5% (b) 20%

(c) Zero (d) 0.5%

Musical Sound

1. The walls of the halls built for music concerts should

[NCERT 1979]

(a) Amplify sound (b) Transmit sound

(c) Reflect sound (d) Absorb sound

2. A spherical source of power 4 *W* and frequency 800 *Hz* is emitting sound waves. The intensity of waves at a distance 200 *m* is **[CPMT 1999; JIPMER 2000]**

(a) $8\times10^{-6}\ W/m^2$ (b) $2\times10^{-4}\ W/m^2$

(c) $1\times10^{-4}\ W/m^2$ (d) $4\ W/m^2$

3. If the pressure amplitude in a sound wave is tripled, then the intensity of sound is increased by a factor of

[CPMT 1992; JIPMER 2000]

(a) 9 (b) 3
(c) 6 (d) $\sqrt{3}$

4. If the amplitude of sound is doubled and the frequency reduced to one-fourth, the intensity of sound at the same point will be **[CBSE PMT 1992]**
(a) Increased by a factor of 2
(b) Decreased by a factor of 2
(c) Decreased by a factor of 4
(d) Unchanged

5. Intensity level of a sound of intensity *I* is 30 *dB*. The ratio $\frac{I}{I_0}$ is (Where I_0 is the threshold of hearing) **[KCET 1999; J & K CET 2005]**
(a) 3000 (b) 1000
(c) 300 (d) 30

6. Decibel is unit of **[RPMT 2000]**
(a) Intensity of light (b) X-rays radiation capacity
(c) Sound loudness (d) Energy of radiation

7. Quality of a musical note depends on **[MP PMT 1998; KCET 1999; RPET 2000]**
(a) Harmonics present
(b) Amplitude of the wave
(c) Fundamental frequency
(d) Velocity of sound in the medium

8. When we hear a sound, we can identify its source from **[KCET (Med.) 2001]**
(a) Amplitude of sound
(b) Intensity of sound
(c) Wavelength of sound
(d) Overtones present in the sound

9. A man x can hear only upto 10 *kHz* and another man y upto 20 *kHz*. A note of frequency 500 *Hz* is produced before them from a stretched string. Then **[KCET 2002]**
(a) Both will hear sounds of same pitch but different quality
(b) Both will hear sounds of different pitch but same quality
(c) Both will hear sounds of different pitch and different quality
(d) Both will hear sounds of same pitch and same quality

10. The amplitude of two waves are in ratio 5 : 2. If all other conditions for the two waves are same, then what is the ratio of their energy densities **[MH CET 2004]**
(a) 5 : 2 (b) 10: 4
(c) 2.5 : 1 (d) 25 : 4

11. *A* is singing a note and at the same time *B* is singing a note with exactly one-eighth the frequency of the note of *A*. The energies of two sounds are equal, the amplitude of the note of *B* is **[NCERT 1981; AIIMS 2001]**
(a) Same that of *A* (b) Twice as that of *A*
(c) Four times as that of *A* (d)Eight times as that of *A*

12. The loudness and pitch of a sound depends on **[KCET 2004; Pb. PET 2003]**
(a) Intensity and velocity
(b) Frequency and velocity
(c) Intensity and frequency
(d) Frequency and number of harmonics

13. If *T* is the reverberation time of an auditorium of volume *V* then **[KCET 2003]**
(a) $T \propto \frac{1}{V}$ (b) $T \propto \frac{1}{V^2}$
(c) $T \propto V^2$ (d) $T \propto V$

14. The intensity of sound from a radio at a distance of 2 *metres* from its speaker is $1 \times 0^{-2} \mu\, Wm^2$. The intensity at a distance of 10 meters would be **[CPMT 2005]**
(a) $0.2 \times 10^{-2} \mu\, Wm^2$ (b) $1 \times 10^{-2} \mu\, Wm^2$
(c) $4 \times 10^{-4} \mu\, Wm^2$ (d) $5 \times 10^{-2} \mu\, Wm^2$

15. The intensity of sound wave while passing through an elastic medium falls down by 10% as it covers one metre distance through the medium. If the initial intensity of the sound wave was 100 *decibels,* its value after it has passed through 3 *metre* thickness of the medium will be **[CPMT 1988]**
(a) 70 *decibel* (b) 72.9 *decibel*
(c) 81 *decibel* (d) 60 *decibel*

16. A musical scale is constructed by providing intermediate frequencies between a note and its octave which

[CPMT 1972; NCERT 1980]

(a) Form an arithmetic progression

(b) Form a geometric progression

(c) Bear a simple ratio with their neighbours

(d) Form a harmonic progression

17. In a harmonium the intermediate notes between a note and its octave form

[CPMT 1973]

(a) An arithmetic progression

(b) A geometric progression

(c) A harmonic progression

(d) An exponential progression

18. The power of a sound from the speaker of a radio is 20 mW. By turning the knob of the volume control, the power of the sound is increased to 400 mW. The power increase in decibels as compared to the original power is

(a) 13 dB (b) 10 dB

(c) 20 dB (d) 800 dB

19. If separation between screen and source is increased by 2% what would be the effect on the intensity **[CPMT 2003]**

(a) Increases by 4% (b) Increases by 2%

(c) Decreases by 2% (d) Decreases by 4%

20. The musical interval between two tones of frequencies 320 Hz and 240 Hz is

[MP PMT 1992; AFMC 1992]

(a) 80 (b) $\left(\frac{4}{3}\right)$

(c) 560 (d) 320×240

21. In an orchestra, the musical sounds of different instruments are distinguished from one another by which of the following characteristics

[CBSE PMT 1993]

(a) Pitch (b) Loudness

(c) Quality (d) Overtones

22. The intensity level due to two waves of the same frequency in a given medium are 1 *bel* and 5 *bel*. Then the ratio of amplitudes is

(a) 1 : 4 (b) 1 : 2

(c) $1 : 10^4$ (d) $1 : 10^2$

23. It is possible to recognise a person by hearing his voice even if he is hidden behind a wall. This is due to the fact that his voice

[CPMT 1972]

(a) Has a definite pitch (b) Has a definite quality

(c) Has a definite loudness (d) Can penetrate the wall

24. Of the following the one which emits sound of higher pitch is

(a) Mosquito (b) Lion

(c) Man (d) Woman

25. In the musical octave 'Sa', 'Re', 'Ga'

(a) The frequency of the note 'Sa' is greater than that of 'Re', 'Ga'

(b) The frequency of the note 'Sa' is smaller than that of 'Re', 'Ga'

(c) The frequency of all the notes 'Sa', 'Re', 'Ga' is the same

(d) The frequency decreases in the sequence 'Sa', 'Re', 'Ga'

26. Tone A has frequency of 240 Hz. Of the following tones, the one which will sound least harmonious with A is

(a) 240 (b) 480

(c) 360 (d) 450

27. Learned Indian classical vocalists do not like the accompaniment of a harmonium because

[MP PMT 1992]

(a) Intensity of the notes of the harmonium is too large

(b) Notes of the harmonium are too shrill

(c) Diatonic scale is used in the harmonium

(d) Tempered scale is used in the harmonium

28. Each of the properties of sound listed in column A primarily depends on one of the quantities in column B. Choose the matching pairs from two columns

Column A	Column B
Pitch	Waveform
Quality	Frequency
Loudness	Intensity

[IIT 1980]

(a) Pitch-waveform, Quality-frequency; Loudness-intensity

(b) Pitch-frequency, Quality-waveform; Loudness-intensity

(c) Pitch-intensity, Quality-waveform; Loudness- frequency

(d) Pitch-waveform, Quality- intensity; Loudness-frequency

29. Intensity level 200 *cm* from a source of sound is 80 *dB*. If there is no loss of acoustic power in air and intensity of threshold hearing is $10^{-12}\,Wm^{-2}$ then, what is the intensity level at a distance of 400 *cm* from source

(a) Zero (b) 54 *dB*

(c) 64 *dB* (d) 44 *dB*

30. 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 **[CBSE PMT 2005]**

(a) 9 : 4 (b) 2 : 3

(c) 3 : 2 (d) 4 : 9

31. Quality depends on **[AFMC 2003]**

(a) Intensity (b) Loudness

(c) Timbre (d) Frequency

32. Two waves having sinusoidal waveforms have different wavelengths and different amplitude. They will be having

[BHU 2005]

(a) Same pitch and different intensity

(b) Same quality and different intensity

(c) Different quality and different intensity

(d) Same quality and different pitch

Critical Thinking

Objective Questions

1. A wave disturbance in a medium is described by $y(x,t) = 0.02\cos\left(50\pi t + \frac{\pi}{2}\right)\cos(10\pi x)$, where x and y are in *metres* and t in seconds

[IIT 1995]

(a) A displacement node occurs at $x = 0.15\ m$

(b) An antinode occurs at $x = 0.3\ m$

(c) The wavelength of the wave is 0.2 *m*

(d) The speed of the wave is 5.0 *m/s*

2. The (x, y) coordinates of the corners of a square plate are (0, 0), (*L*, 0), (*L*, *L*) and (0, *L*). The edges of the plate are clamped and transverse standing waves are set up in it. If $u(x, y)$ denotes the displacement of the plate at the point (x, y) at some instant of time, the possible expression(s) for u is(are) (a = positive constant)

[IIT 1998; Orissa PMT 2004]

(a) $a\cos\frac{\pi x}{2L}\cos\frac{\pi y}{2L}$ (b) $a\sin\frac{\pi x}{L}\sin\frac{\pi y}{L}$

(c) $a\sin\frac{\pi x}{L}\sin\frac{2\pi y}{L}$ (d) $a\cos\frac{2\pi x}{L}\cos\frac{\pi y}{L}$

3. The ends of a stretched wire of length L are fixed at $x = 0$ and $x = L$. In one experiment, the displacement of the wire is $y_1 = A\sin(\pi x/L)\sin\omega t$ and energy is E_1, and in another experiment its displacement is $y_2 = A\sin(2\pi x/L)\sin 2\omega t$ and energy is E_2. Then

[IIT-JEE (Screening) 2001]

(a) $E_2 = E_1$ (b) $E_2 = 2E_1$

(c) $E_2 = 4E_1$ (d) $E_2 = 16E_1$

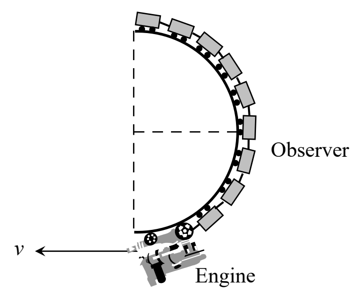
4. In a large room, a person receives direct sound waves from a source 120 *metres* away from him. He also receives waves from the same source which reach him, being reflected from the 25 *metre* high ceiling at a point halfway between them. The two waves interfere constructively for wavelength of

[Roorkee 1982]

(a) 20, 20/3, 20/5 *etc* (b) 10, 5, 2.5 *etc*

(c) 10, 20, 30 *etc* (d) 15, 25, 35 *etc*

5. A train has just complicated a *U*-curve in a track which is a semicircle. The engine is at the forward end of the semi circular part of the track while the last carriage is at the rear end of the semicircular track. The driver blows a whistle of frequency 200 *Hz.* Velocity of sound is 340 *m/sec.* Then the apparent frequency as observed by a passenger in the middle of a train when the speed of the train is 30 *m/sec* is



(a) 209 Hz (b) 288 Hz

(c) 200 Hz (d) 181 Hz

6. Two identical flutes produce fundamental notes of frequency 300 Hz at $27^o C$. If the temperature of air in one flute is increased to $31^o C$, the number of the beats heard per second will be **[UPSEAT 2002]**

(a) 1 (b) 2

(c) 3 (d) 4

7. In the experiment for the determination of the speed of sound in air using the resonance column method, the length of the air column that resonates in the fundamental mode, with a tuning fork is 0.1 m. when this length is changed to 0.35 m, the same tuning fork resonates with the first overtone. Calculate the end correction

[IIT-JEE (Screening) 2003]

(a) 0.012m (b) 0.025m

(c) 0.05m (d) 0.024m

8. A closed organ pipe of length L and an open organ pipe contain gases of densities ρ_1 and ρ_2 respectively. The compressibility of gases are equal in both the pipes. Both the pipes are vibrating in their first overtone with same frequency. The length of the open organ pipe is

[IIT-JEE (Screening) 2004]

(a) $\frac{L}{3}$ (b) $\frac{4L}{3}$

(c) $\frac{4L}{3}\sqrt{\frac{\rho_1}{\rho_2}}$ (d) $\frac{4L}{3}\sqrt{\frac{\rho_2}{\rho_1}}$