Shiksha Classes Bhandara
CHAPTER TEST

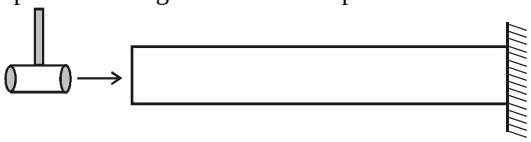
Subject : Physics **Topic : Waves** **M.M. : 100**

Marking Scheme:

(i) Each question is allotted 4 (four) marks for each correct response.

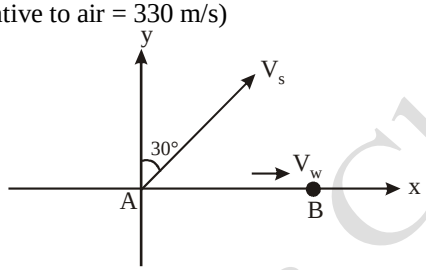
(ii) ¼ (one fourth) marks will be deducted for indicating incorrect response of each question. No deduction from the total score will be made if no response is indicated for an item in the answer sheet.

Q.1 A 100 m long rod of density 10.0×10^4 kg/m^3 and having young's modulus Y = 10^{11} Pa, is clamped at one end. It is hammered at the other free end. The longitudinal pulse goes to right end, gets reflected and again returns to the left end. How much time, the pulse take to go back to initial point.



(A) 2 sec (B) 1 sec
(C) 5 sec. (D) 0.2 sec

Q.2 In the figure shown a source of sound of frequency 510Hz moves with constant velocity v_s = 20 m/s in the direction shown. The wind is blowing at a constant velocity v_w = 20 m/s towards an observer who is at rest at point B. Corresponding to the sound emitted by the source at initial position A, find the frequency detected by the observer. (Speed of sound relative to air = 330 m/s)



(A) 525 Hz (B) 600 Hz
(C) 415 Hz (D) 250 Hz

Q.3 A stationary observer receives sonic oscillations from two tuning forks, one of which approaches and the other recedes with same speed. As this takes place the observer hears the beat frequency of 2 Hz. Find the speed of each tuning fork, if their oscillation frequency is 680 Hz and the velocity of sound in air is 340 m/s –
(A) 1 m/s (B) 2 m/s
(C) 0.5 m/s (D) 1.5 m/s

Q.4 A note has a frequency of 128 Hz. The frequency of a note which is two octave higher than this is
(A) 256 Hz (B) 320 Hz
(C) 400 Hz (D) none of these

Q.5 Two coherent sources of different intensities send waves which interfere. The ratio of the maximum intensity to the minimum intensity is 25. The intensities are in the ratio –
(A) 25 : 1 (B) 5 : 1
(C) 9 : 4 (D) 625 : 1

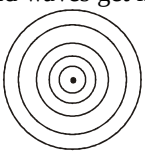
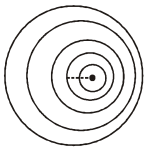
Q.6 The frequency of a man's voice is 300 Hz and its wavelength is 1 meter. If the wavelength of a child's voice is 1.5m, then the frequency of the child's voice is –
(A) 200 Hz (B) 150 Hz
(C) 400 Hz (D) 350 Hz

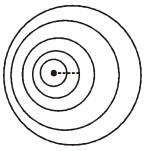
Q.7 A sound wave of frequency 440 Hz is passing through air. An O_2 molecule (mass = 5.3×10^{-26} kg) is set in oscillation with an amplitude of 10^{-6} m. Its speed at the centre of its oscillation is –
(A) 1.70×10^{-5} m/s (B) 17.0×10^{-5} m/s
(C) 2.76×10^{-3} m/s (D) 2.77×10^{-5} m/s

Q.8 A string fixed at both ends has consecutive standing wave modes for which the distances between adjacent nodes are 18cm. and 16cm respectively. The minimum possible length of the string is –
(A) 144 cm. (B) 152 cm.
(C) 176 cm. (D) 200 cm.

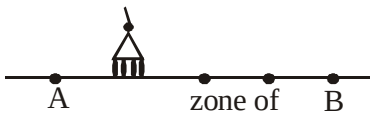
Q.9 The extension in a string, obeying Hooke's law, is x. The speed of sound in the stretched string is v. If the extension in the string is increased to 1.5x, the speed of sound will be
(A) 1.22 v (B) 0.61 v
(C) 1.50 v (D) 0.75 v

Q.10 If the source is moving towards right, wave front of sound waves get modified to –

(A)  (B) 

(C)  (D) None of these

Q.11 There are cases when an explosion at a point A will be heard at point B that is far away from A while in a certain region located much closer to A than to B, the explosion is not heard due to obstruction. This will be possible if



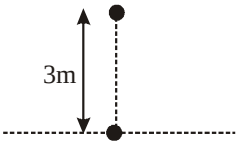
(A) If air temperature increases with altitude
(B) If air temperature decreases with altitude
(C) If air is blowing from B to A
(D) If air is blowing from A to B

Q.12 A uniform rope of length 12m and mass 6 kg hangs from a rigid support. A block of mass 2 kg is attached to the free end of the rope. A transverse pulse of wavelength 0.06 m is produced at the lower end of the rope. What is the wavelength of the pulse when it reaches the top of the rope ?
(A) 5.12 m (B) 0.12 m
(C) 4.32 m (D) 1.23m

Q.13 Two tuning forks A and B sounded together give 6 beats per second. With an air resonance tube closed at one end, the two forks give resonance when the two air columns are 24 cm and 25 cm respectively. Calculate the frequencies of forks.
(A) 120 Hz, 124 Hz (B) 110 Hz, 114 Hz
(C) 150 Hz, 144 Hz (D) 170 Hz, 118 Hz

Q.14 A metre-long tube open at one end, with a movable piston at the other end, shows resonance with a fixed frequency source (a tuning fork of frequency 340 Hz) when the tube length is 25.5 cm or 79.3 cm. Estimate the speed of sound in air at the temperature of the experiment. The edge effects may be neglected.
(A) 165.84 ms^{-1} (B) 305.84 ms^{-1}
(C) 365.84 ms^{-1} (D) 325.84 ms^{-1}

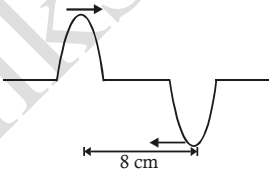
Q.15 S_1 and S_2 are two coherent sources of sound having no initial phase difference. The velocity of sound is 330 m/s. No minima will be formed on the line passing through S_2 and perpendicular to the line joining S_1 and S_2, if the frequency of both the sources is



(A) 50 Hz (B) 60 Hz
(C) 70 Hz (D) 80 Hz

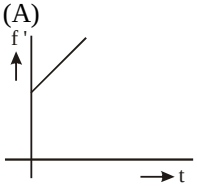
Q.16 The ends of a stretched wire of length L are fixed at x= 0 and x = L. In one experiment, the displacement of the wire is $y_1 = A\sin(\pi x/L)\sin\omega t$ and energy is E_1 and in another experiment its displacement is $y_2 = A\sin(2\pi x/L)\sin 2\omega t$ and energy is E_2. Then
(A) $E_2 = E_1$ (B) $E_2 = 2E_1$
(C) $E_2 = 4E_1$ (D) $E_2 = 16E_1$

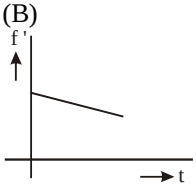
Q.17 Two pulses is a stretched string whose centers are initially 8cm apart are moving towards each other as shown in the figure. The speed of each pulse is 2cm/s. After 2 second, the total energy of the pulses will be :

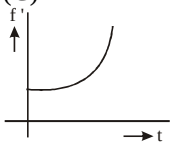


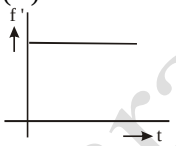
(A) zero
(B) purely kinetic
(C) purely potential
(D) partly kinetic and partly potential.

Q.18 A source of frequency f is stationary and an observer starts moving towards at it at t = 0 with constant small acceleration. Then the variation of observed frequency f registered by the observer with time is best represented as–

(A)


(B)


(C)


(D)


Q.19 A closed organ pipe has length ℓ. The air in it is vibrating in 3rd overtone with maximum amplitude 'a'. The amplitude at a distance of $\ell/7$ from closed end of the pipe is equal to
(A) a (B) a/2
(C) $\frac{a\sqrt{3}}{2}$ (D) zero

Q.20 Under similar conditions of temperature and pressure, in which of the following gases the velocity of sound will be largest –
(A) H_2 (B) N_2
(C) He (D) CO_2

For Q.21-Q.25 :
The answer to each question is a NUMERICAL VALUE.

Q.21 Two vibrating strings of the same material but length 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 ν_1 and the other with frequency ν_2. The ratio ν_1/ν_2 is given by :

Q.22 The displacement y of a particle executing periodic motion is given by $y = 4\cos^2(t)\sin(1000t)$. This expression may be considered to be a result of the superposition of waves :

Q.23 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 than the fundamental frequency of the open pipe. The fundamental frequency (in Hz) of the open pipe is

Q.24 A point source is emitting sound in all directions. Find the ratio of distance of two points from the point source is $\frac{1}{\sqrt{X}}$, where the difference in loudness levels is 3 dB. ($\log_{10} 2 = 0.3$)

Q.25 A siren placed at a railway platform is emitting sound of frequency 5kHz. 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 be 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 :