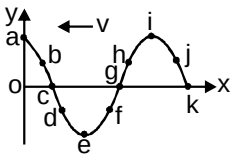
Exercise - II

(ONLY ONE OPTION IS CORRECT)

Question No. 1 to 6 (6 questions)

The figure represents the instantaneous picture of a longitudinal harmonic wave travelling along the negative x-axis. Identify the correct statement(s) related to the movement of the points shown in the figure.



1. The points moving in the direction of wave are
(A) b (B) c
(C) f (D) i

2. The points moving opposite to the direction of propagation are
(A) a (D) d
(C) f (D) j

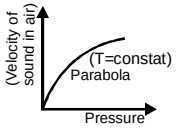
3. The stationary points are
(A) a (B) c
(C) g (D) k

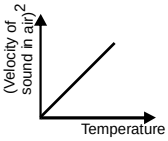
4. The maximum displaced points are
(A) a (B) e
(C) g (D) i

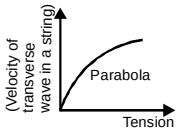
5. The points of maximum compression are
(A) c (B) g
(C) e (D) k

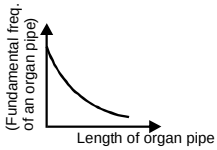
6. The points of maximum rarefaction are
(A) a (B) e
(C) g (D) i

7. Which of the following graphs is/are correct.

(A) 

(B) 

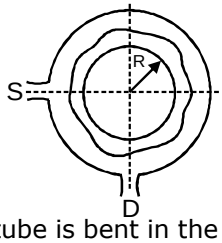
(C) 

(D) 

8. Which of the following statements are wrong about the velocity of sound in air :
(A) decreases with increases in temperature
(B) increases with decrease in temperature
(C) decreases as humidity increases
(D) independent of density of air.

9. Two interfering waves have the same wavelength, frequency, and amplitude, They are traveling in the same direction but are 90° out of phase. Compared to the individual waves, the resultant wave will have the same.
(A) amplitude and velocity but different wavelength
(B) amplitude and wavelength but different velocity
(C) wavelength and velocity but different amplitude
(D) amplitude and frequency but different velocity.

Question No. 10 to 15 (5 questions)



A narrow tube is bent in the form of a circle of radius R, as shown in the figure. Two small holes S and D are made in the tube at the positions right angle to each other. A source placed at S generated a wave of intensity I_0 which is equally divided into two parts : One part travels along the longer path, while the other travels along the shorter path. Both the part waves meet at the point D where a detector is placed

10. If a maxima is formed at the detector then, the magnitude of wavelength λ of the wave produced is given by
(A) πR (B) $\frac{\pi R}{2}$
(C) $\frac{\pi R}{4}$ (D) $\frac{2\pi R}{3}$

11. If the minima is formed at the detector then, the magnitude of wavelength λ of the wave produced is given by
(A) $2\pi R$ (B) $\frac{3\pi R}{2}$
(C) $\frac{2\pi R}{3}$ (D) $\frac{2\pi R}{5}$

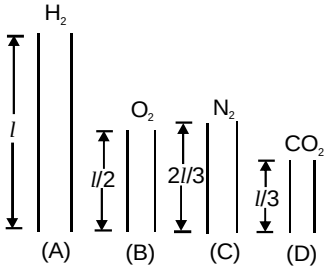
12. The maximum intensity produced at D is given by
(A) $4I_0$ (B) $2I_0$
(C) I_0 (D) $3I_0$

13. The maximum value of λ to produce a maxima at D is given by
(A) πR (B) $2\pi R$
(C) $\frac{\pi R}{2}$ (D) $\frac{3\pi R}{2}$

14. The maximum value of λ to produce a minima at D is given by
(A) πR (B) $2\pi R$
(C) $\frac{\pi R}{2}$ (D) $\frac{3\pi R}{2}$

15. The second overtone of an open organ pipe A and a closed pipe B have the same frequency at a given temperature. If follows that the ratio of the
(A) length of A and B is 4 : 3
(B) fundamental frequencies of A & B is 5 : 6
(C) lengths of B to that of A is 5 : 6
(D) frequencies of first overtone of A & B is 10 : 9

16. Four open organ pipes of different lengths and different gases at same temperature as shown in figure. Let f_A, f_B, f_C and f_D be their fundamental frequencies then : [Take $\gamma_{CO_2} = 7/5$]



(A) $f_A / f_B = \sqrt{2}$ (B) $f_B / f_C = \sqrt{72/28}$
(C) $f_C/f_D = \sqrt{11/28}$ (D) $f_D / f_A = \sqrt{76/11}$

17. A gas is filled in an organ pipe and it is sounded with an organ pipe in fundamental mode. Choose the correct statement(s) : (T = constant)
(A) If gas is changed from H_2 to O_2, the resonant frequency will increase
(B) If gas is changed from O_2 to N_2, the resonant frequency will increase
(C) If gas is changed from N_2 to He, the resonant frequency will decrease
(D) If gas is changed from He to CH_4, the resonant frequency will decrease

18. A closed organ pipe of length 1.2 m vibrates in its first overtone mode. The pressure variation is maximum at :
(A) 0.8m from the open end
(B) 0.4 m from the open end
(C) at the open end
(D) 1.0 m from the open end

19. For a certain organ pipe three successive resonance frequencies are observed at 425 Hz, 595 Hz and 765 Hz respectively. If the speed of sound in air is 340 m/s, then the length of the pipe is
(A) 2.0 m (B) 0.4 m
(C) 1.0 m (D) 0.2 m

20. In an organ pipe whose one end is at x = 0, the pressure is expressed by $p = p_0 \cos\frac{3\pi x}{2}\sin 300\pi t$ where x is in meter and t in sec. The organ pipe can be
(A) closed at one end, open at another with length = 0.5 m
(B) open at both ends, length = 1m
(C) closed at both ends, length = 2m
(D) closed at one end, open at another with length = $\frac{2}{3}$m

21. Two whistles A and B each have a frequency of 500 Hz. A is stationary and B is moving towards the right (away from A) at a speed of 50 m/s. An observer is between the two whistles moving towards the right with a speed of 25 m/s. The velocity of sound in air is 350 m/s. Assume there is no wind. Then which of the following statements are true.
(A) The apparent frequency of whistle B as heard by A is 444Hz approximately
(B) The apparent frequency of whistle B as heard by the observer is 469 Hz approximately
(C) The difference in the apparent frequencies of A and B as heard by the observer is 4.5 Hz
(D) The apparent frequencies of the whistles of each other as heard by A and B are the same

22. A source of sound moves towards an observer
(A) the frequency of the source is increased
(B) the velocity of sound in the medium is increased
(C) the wavelength of sound in the medium towards the observer is decreased
(D) the amplitude of vibration of the particles is increased

23. A car moves towards a hill with speed v_c. It blows a horn of frequency f which is heard by an observer following the car with speed v_0. The speed of sound in air is v.
(A) the wavelength of sound reaching the hill is $\frac{v}{f}$
(B) the wavelength of sound reaching the hill is $\frac{v - v_c}{f}$
(C) the beat frequency observed by the observer is $\left(\frac{v + v_0}{v - v_c}\right)f$
(D) the beat frequency observed by the observer is $\frac{2v_c(v + v_0)f}{v^2 - v_c^2}$