Sound

1. The frequency of a source is 20 kHz. The frequencies of the sound waves produced by it in water and air will
(a) Be the same as that of the source
(b) Depend upon the velocity of the waves in these media
(c) Depend upon the wavelength of the waves in these media
(d) Depend upon the density of the media.

2. A.R. Rehman is conducting a musical night in an open auditorium in New York. If a person who is sitting in the auditorium at a distance of 250 m from the stage and the other who is watching the live program on a television set sitting in front of it in Hyderabad, then the person who hear him first is the
(a) Person sitting in auditorium
(b) Person sitting in Hyderabad
(c) Both will hear at the time
(d) Cannot be said.

3. Read the given statements and select the correct option,
Statement 1: Echo is produced when sound is incident on hard and polished surface.
Statement 2: Sound energy can be totally reflected by objects with soft and loose texture.

(a) Both statements 1 and 2 are true and statement 2 is the correct explanation of statement 1.
(b) Both statements 1 and 2 are true but statement 2 is not the correct explanation of statement 1.
(c) Statement 1 is true but statement 2 is false.
(d) Both statements 1 and 2 are false.

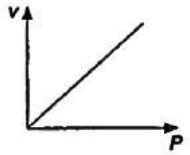
4. Match the column I with column II and mark the correct option from the codes given below.

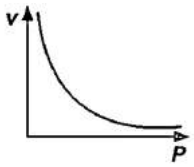
	Column I	Column II
(A)	String vibration	(i) Tabia
(B)	Membrane vibration	(ii) Bicycle bell
(C)	Vibration of air column	(iii) Sitar
(D)	Vibration of plate	(iv) Flute

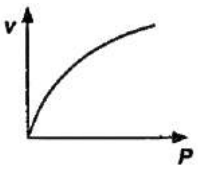
(a) (A) - (i), (B) - (iv), (C) - (ii), (D) - (iii)
(b) (A) - (iii), (B) - (i), (C) - (iv), (D) - (ii)
(c) (A) - (iv), (B) - (ii), (C) - (iii), (D) - (i)
(d) (A) - (ii), (B) - (iii), (C) - (i), (D) - (iv)

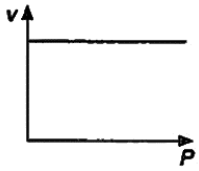
5. The roofs and walls of the auditorium are generally covered with sound absorbent materials to reduce
(a) Velocity of sound
(b) Reverberation of sound
(c) Frequency of sound
(d) None of these

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

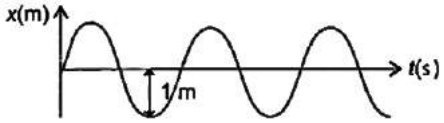
(a) 

(b) 

(c) 

(d) 

7. A sound wave travelling in a medium is represented as shown in figure.



If vibrating source of sound makes 360 oscillations in 2 minutes, then the amplitude, wavelength and frequency of the sound wave respectively are (Take velocity of sound as $342\ m\ s^{-1}$)
(a) 1 m, 114 m and 3 Hz
(b) 2 m, 3 m and 14 Hz
(c) 1 m, 5 m and 20 Hz
(d) 1 m, 100 m and 10 Hz.

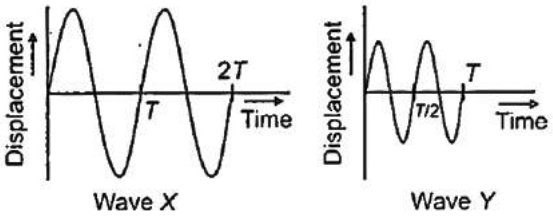
8. A submarine emits a SONAR pulse which returns from an underwater cliff in 1.05 second. If the speed of sound in salt water is $1531\ m\ s^{-1}$, how far away is the cliff?
(a) $1568\ m$ (b) $803.7\ m$

(c) 1607.4 m (d) 765.5 m

9. Longitudinal wave can travel in
(a) solids only
(b) liquids only
(c) liquids and gases only
(d) all media

10. Sound travels with a speed of about $330\ m\ s^{-1}$. What is the wavelength of sound whose frequency is 660 Hz?
(a) 5 m (b) 50 m
(c) 0.5 m (d) 500 m

11. The diagram represents two different sound waves.



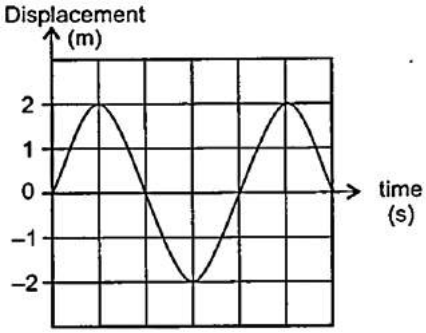
(a) The frequency of X is less than Y and pitch of X is less than Y.
(b) The frequency and pitch of X is same as the frequency and pitch of Y.
(c) The frequency of X is less than Y but its pitch is same as Y.
(d) The frequency of X is same as Y but its pitch is higher than Y.

12. The diagram shows the positions of the air particles due to propagation of sound, represented by straight lines, at a particular instant from P to Q.

Which of the following statements correctly depicts the pressure variation with respect to distance?
(a) The lines which are closed to one another represent rarefaction which is a low pressure region.
(b) The lines which are far apart from one another represent compression which is a low pressure region.
(c) The lines which are far apart from one another represent rarefaction which is high pressure region.
(d) The lines which are closed to one another represent compression which is a high pressure region.

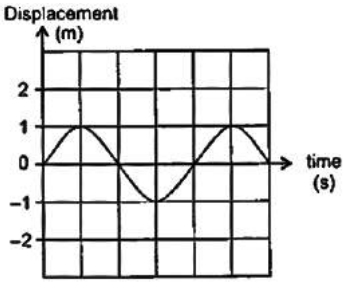
13. There are two walls A and B which are 180 m apart from each other. A boy standing at 60 m away from wall A claps his hands once. If the speed of sound in air is $330\ m\ s^{-1}$, what is the time interval between the first and the second echo that he hears?
(a) 0.36 s (b) 0.24 s
(c) 0.4 s (d) 1 s

14. A microphone is connected to a cathode ray oscilloscope. A loudspeaker giving a single note is switch on. The trace shown in the figure appears on the screen.

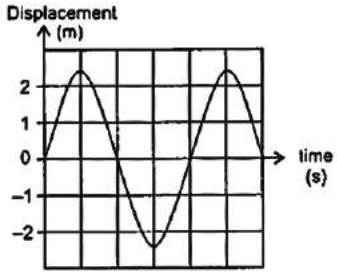


Which of the following shows the softer but same frequency note of the given note?

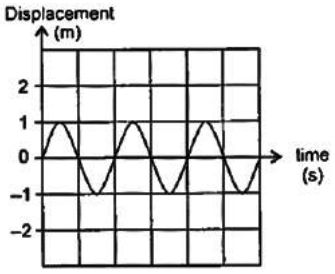
(a)



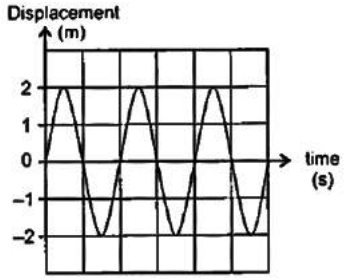
(b)



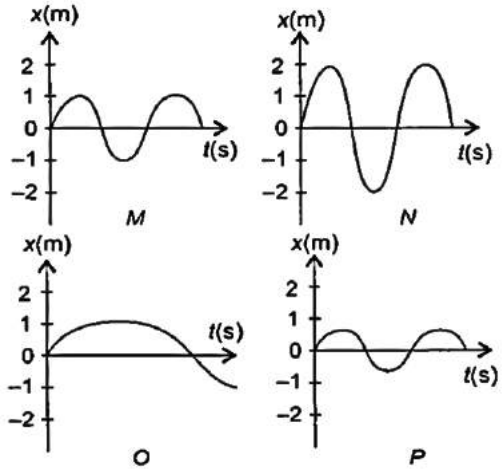
(c)



(d)



15. Four sound waves M, N, O and P are shown in figures below. Which of the following is correct statement?



(a) M and P have the same loudness.
(b) N and O have the same loudness.
(c) N and P have the same loudness.
(d) M and O have the same loudness.

Achievers Section (HOTS)

16. Which of the following statements is correct, when two sound waves with same frequency and constant phase difference interfere?
(a) There is a gain of energy.
(b) There is a loss of energy.
(c) The energy is redistributed as direction change.
(d) The energy is redistributed and the distribution remains constant in time.

Direction (Q. No. 17 and 18): Read the passage carefully and answer the following questions.
Two tuning forks, A and B vibrate with frequencies in the ratio 2 : 7 and their wavelengths in the ratio 3 : 4 respectively. Both the tuning forks are placed in different media.

17. Find the tuning fork producing greater velocity of sound.
(a) Tuning fork A
(b) Tuning fork B
(c) Both produce sound of same velocity
(d) Cannot say

18. The tuning fork A produces relatively
(a) Shrill sound than tuning fork B
(b) Flat sound than tuning fork B
(c) Louder sound than tuning fork B
(d) Sound of more wavelength than that of tuning fork B.

19. A man standing in front of a large wall claps at a regular frequency of 10 Hz. He finds that the echoes coincide with his clapping.
(The speed of sound in air is $330\ m\ s^{-1}$.)
(i) Time taken between successive clapping is 0.1 s.
(ii) The distance between the man and the wall, after he stops clapping, if he hears one more echo is 33 m.
(iii) The distance between the man and the wall, after he stops clapping, if he hears four more echoes is 66 m.

(a) Only (i) and (ii) are correct.
(b) Only (ii) and (iii) are correct.
(c) Only (i) and (iii) are correct.
(d) All (i), (ii) and (iii) are correct.

20. A stone is dropped from the top of a tower of 125 m high into a pond which is at base of the tower. When will the splash be heard at the top? (Given $g = 10\ m\ s^{-2}$ and speed of sound $= 340\ m\ s^{-1}$.)
(a) 5 s (b) 0.36 s
(c) 5.36 s (d) 2 s

Answer key

1. A	**2.** B	**3.** C	**4.** B	**5.** B
6. D	**7.** A	**8.** B	**9.** D	**10.** C
11. A	**12.** D	**13.** A	**14.** A	**15.** D
16. D	**17.** B	**18.** B	**19.** C	**20.** C

HINTS & EXPLANATIONS

1. (a) : Frequency of the sound waves is independent of the medium. It will be same in water as well as in air.

2. (b) : Here, distance from stage = 250 m (given)
Speed of sound $= 330\ \text{m s}^{-1}$
So, time taken by person sitting in the auditorium to hear him $= \frac{250}{330} = \frac{25}{33} s$
While person sitting in front of T.V. will hear him instantly as electronic signals travel with speed of light.

3. (c) : Sound energy gets partially absorbed by objects with soft and loose texture.

4. (b) Not Available

5. (b) : Persistence of sound in a closed enclosure, due to continuous reflections at the walls is known as reverberation. In an auditorium or big hall excessive reverberation is highly undesirable, so the roof and walls are generally covered with sound absorbent material.

6. (d) Not Available

7. (a) : Here, amplitude of sound wave = 1 m (given) Wavelength of sound wave,
$\lambda = \frac{v_s}{v} \quad \ldots(i)$
In 2 minutes, number of oscillations = 360
In 1 second, number of oscillations $= \frac{360}{2 \times 60} = 3$
$\therefore$ Frequency of sound wave, $\nu = 3$ Hz
Put the value of v in (i),
$\therefore$ Wavelength of sound wave,
$\lambda = \frac{342}{3} = 114m$

8. (b) :Time taken = 1.05 s
Speed of sound in salt water $= 1531\ \text{m s}^{-1}$
Distance travelled by pulse from submarine to the cliff and back to submarine,
$2 \times \text{Distance} = 1531 \times 1.05$
$\therefore$ Distance between cliff and submarine,
$S = \frac{1531 \times 1.05}{2} = 803.7m$

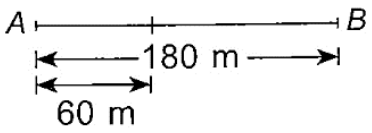
9. (d) Not Available

10. (c) : Speed of sound, $v_s = 330 ms^{-1}$
Frequency of sound, $v = 660 Hz$
$\therefore$ Wavelength of sound,
$\lambda = \frac{v_s}{v} = \frac{330}{660} = \frac{1}{2} = 0.5\,\text{m}$

11. (a) : The frequency of wave X is lower than wave Y, hence its pitch is lower than wave Y too. The pitch of sound depends on the frequency.

12. (d) :The lines which are closed to one another represent compression which is a high pressure region. The lines which are far apart from one another represent rarefaction which is low pressure region.

13. (a) :



Let t_1 be the time taken between the clap and the first echo from wall A.
Let t_2 be the time taken between the clap and the second echo from wall B.
$t_1 = \frac{(2 \times 60)}{330} s; t_2 = \frac{(2 \times 120)}{330} s$
The time interval
$= t_2 - t_1 = \frac{(2 \times 120)}{330} - \frac{(2 \times 60)}{330} = 0.36s$

14. (a) : The sound wave having less amplitude will be softer.

15. (d) : The loudness depends on the amplitude of sound waves.

16. (d) Not Available

17. (b) : Given,

$\frac{v_A}{v_B} = \frac{2}{7}$ …(i)

And $\frac{\lambda_A}{\lambda_B} = \frac{3}{4}$ …(ii)

$\because$ Velocity of sound, $v = \lambda v$

Multiplying (i) and (ii), we get $\frac{V_A}{V_B} = \frac{6}{28} = \frac{3}{14}$

$\therefore$ Velocity of sound produced by tuning fork B is greater.

18. (b) : Lower frequency produces bass or flat sound. So, tuning fork A produces flat sound comparatively.

19. (c) : (i) Time taken between successive clapping $= \frac{1}{10} s = 0.1s$

(ii) Since one echo is heard, so the time taken between the last clap and its echo $= \frac{1}{10} s$

Distance $= 330 \times \frac{1}{10} \times \frac{1}{2} = 16.5\,\text{m}$

(iii) Since four echoes are heard, the time taken between the last clap and the echo

$= 4 \times \frac{1}{10} = \frac{4}{10} s$

Distance $= 330 \times \frac{4}{10} \times \frac{1}{2} = 66\,\text{m}$

20. (c) : Initial velocity, u = 0 (body at rest)

Let t_1 be the time taken by the stone to reach the pond.

For a freely falling body

$h = ut + \frac{1}{2} gt^2 \Rightarrow 125 = 0 \times t_1 + \frac{1}{2} 10 \times t_1^2$

$t_1^2 = 25 \Rightarrow t_1 = 5s$

Let the time taken by sound to reach the top $= t_2$

Speed $= \frac{\text{Distance}}{\text{Time}}$ or $340 = \frac{125}{t_2}$

$t_2 = \frac{125}{340} = 0.36s$

Time after which splash will be heard at the top

$= t_1 + t_2 = 5 + 0.36 = 5.36s$