PHYSICS

BOOKS - SELINA PHYSICS (ENGLISH)

SOUND

Examples

1. The human ear can detect continuous sounds in the frequency range from 20 Hz to 20,000 Hz, Assuming that the speed of sound

in air is $330ms^{-1}$ for all frequencies, calculate the wavelengths corresponding to the given extreme frequencies of the audible range.

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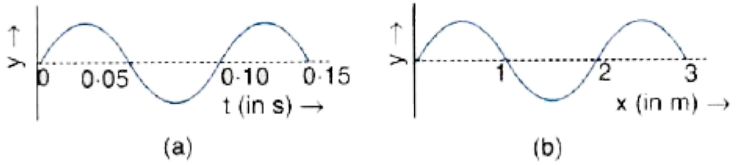
2. The diagram below shows (a) displacement-time, and (b) displacement-distance, graph of a wave travelling in a string with velocity 20 m s^{-1}. In each case, use the graph to calculate the frequency and wavelength of the wave.



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3. A sound produced on the surface of a lake takes 4-5 s to reach a boatman. How much time will it take to reach a diver inside water at the same distance if speed of sound in water is 4.5 times the speed of sound in air ?

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4. A boy hears an echo of his own voice from a distant hill after one second. The speed of sound in air is 350 m s^{-1}. What is the distance of the hill from the boy?

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5. A “RADAR' is able to detect the reflected waves from an enemy's aeroplane after a time interval of 0:02 milli-second. If the velocity of

the waves is $3 \times 10^8 ms^{-1}$, calculate the distance of the aeroplane from the radar.

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6. A boy standing in front of a wall at a distance of 85 m produces 2 claps per second. He notices that the sound of his clapping coincides with the echo. The echo is heard only once when clapping is stopped. Calculate the speed of sound.

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7. A boy stands 60 m in front of a tall wall and claps. The boy continues to clap every time an echo is heard. Another boy finds that the time taken between the first and fifty-first clap is 18 s. Calculate the speed of sound.

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8. A man standing in front of a vertical cliff fires a gun. He hears the echo after 3 s. On moving closer to the cliff by 82-5 m, he fires

again and hears the echo after 2.5 s. Find :

the distance of the cliff from the initial position of the man,

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9. A man standing in front of a vertical cliff fires a gun. He hears the echo after 3 s. On moving closer to the cliff by 82.5 m, he fires again and hears the echo after 2.5 s. Find :

the speed of sound.

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10. A person standing between two vertical cliffs and 640 m away from the nearest cliff, produces sound. He hears the first echo after 4 s and the second echo 3 s later. Calculate : the speed of sound in air,

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11. A person standing between two vertical cliffs and 640 m away from the nearest cliff, produces sound. He hears the first echo after

4 s and the second echo 3 s later. Calculate :

the distance between the cliffs

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12. In a SONAR, ultrasonic waves are sent into the sea water and the reflected waves from a sunken ship are received after 2.0 s. If the velocity of waves in sea water is 1450 m s^{-1}, find the depth of the sunken ship.

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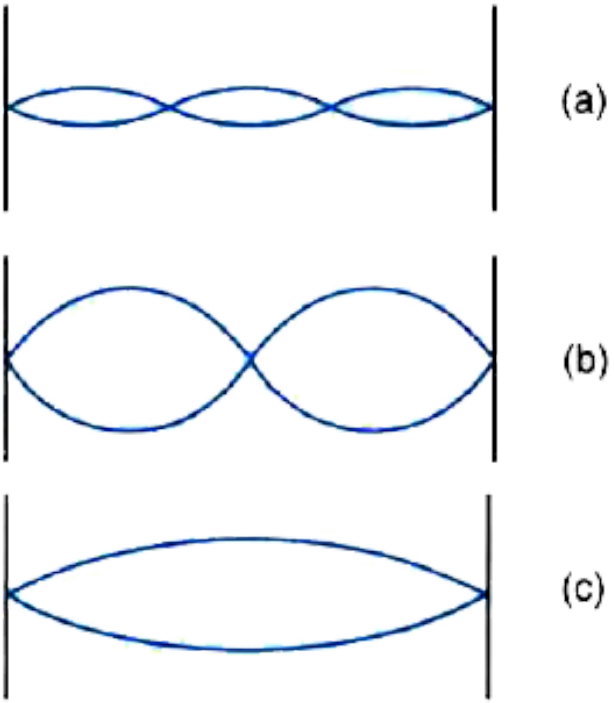
13. Fig. shows three different modes of vibration of a string of length I.



Which vibration is of the largest amplitude ?

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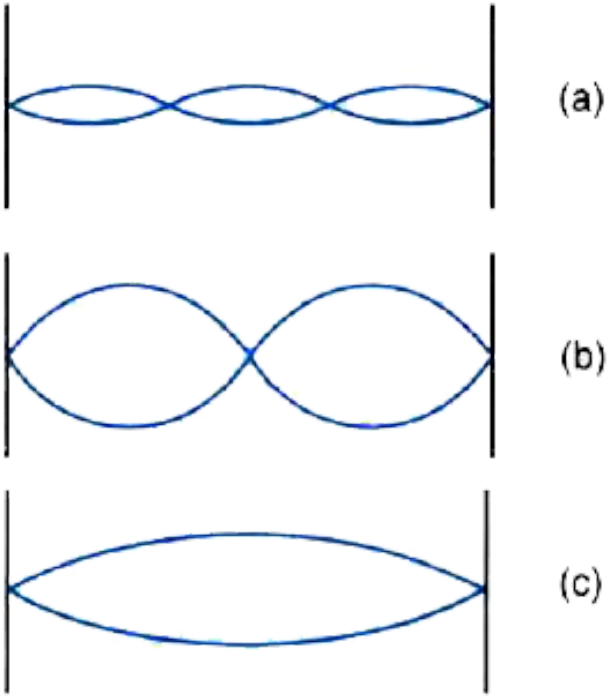
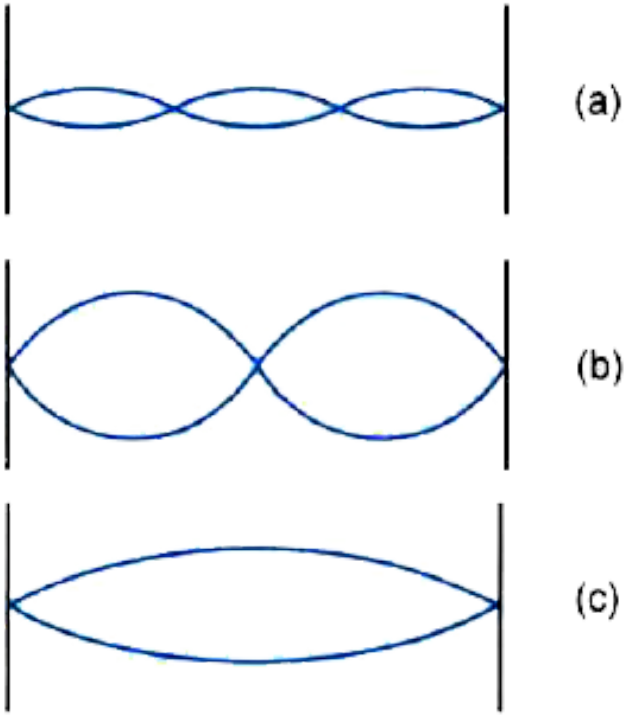
14. Fig. shows three different modes of vibration of a string of length I.



Which vibration is of the least frequency?

View Text Solution

15. Fig. shows three different modes of vibration of a string of length I.



What is the ratio of frequency between (a) and (c)?

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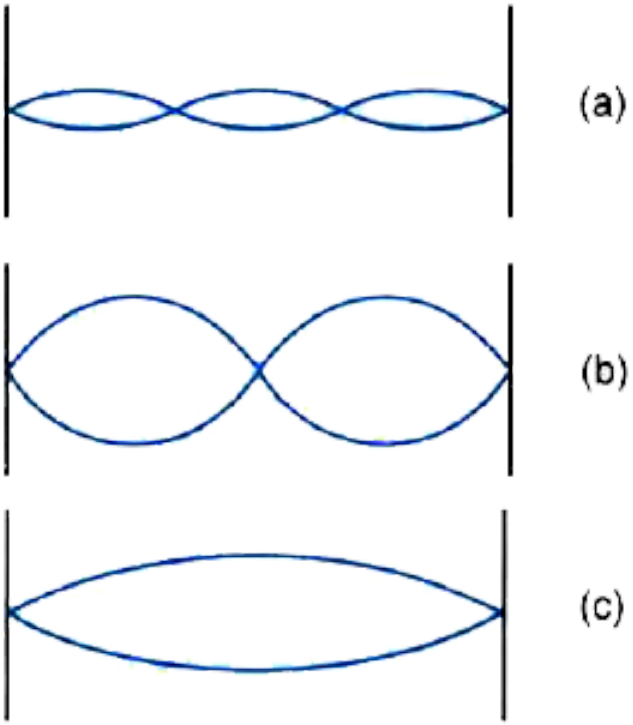
16. Fig. shows three different modes of vibration of a string of length I.



What is the ratio of wavelength between (b) and (a)?

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17. A wire of length 80 cm has a frequency of 256 Hz. Calculate the length of a similar wire under similar tension, which will have frequency of 1024 Hz.

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18. The stem of a vibrating tuning fork is pressed against a table top.

Will it produce an audible sound ?

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19. The stem of a vibrating tuning fork is pressed against a table top.

Does it cause the table top to set in vibrations ? If yes, what type of vibrations are they?

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20. The stem of a vibrating tuning fork is pressed against a table top.

Under what condition does it lead to resonance ?

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21. A wire is stretched between two bridges A and B. A small piece of paper of shape A (called rider) is placed at the middle of the wire. When the stem of a tuning fork P is placed at the bridge A the rider only vibrates, but it flies away when another tuning fork Q is placed. Explain the difference.

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22. A vibrating tuning fork is placed over the mouth of a burette filled with water. The tap is opened and the water level gradually falls. What do you observe ? Name the phenomenon. When does it happen?

Watch Video Solution

23. A vibrating tuning fork is placed over the mouth of a burette filled with water. The tap is

opened and the water level gradually falls. What do you observe ? Name the phenomenon. When does it happen?

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24. The natural frequency of an air column in a pipe fixed at one end, of length 17 cm is 500 Hz. At what length of air column, a tuning fork of frequency 250 Hz will resonate with it?

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25. Sometimes when a vehicle is driven at a particular speed, a rattling sound is heard. Explain briefly, why does this happen and give the name of the phenomenon taking place. Suggest one way by which the rattling sound could be stopped.

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26. A string vibrates with a natural frequency of 256 Hz. Which of the tuning fork given below will resonate with the string ? (i) A of

frequency 512 Hz, (ii) B of frequency 256 Hz, and (iii) C of frequency 128 Hz. Give reason.

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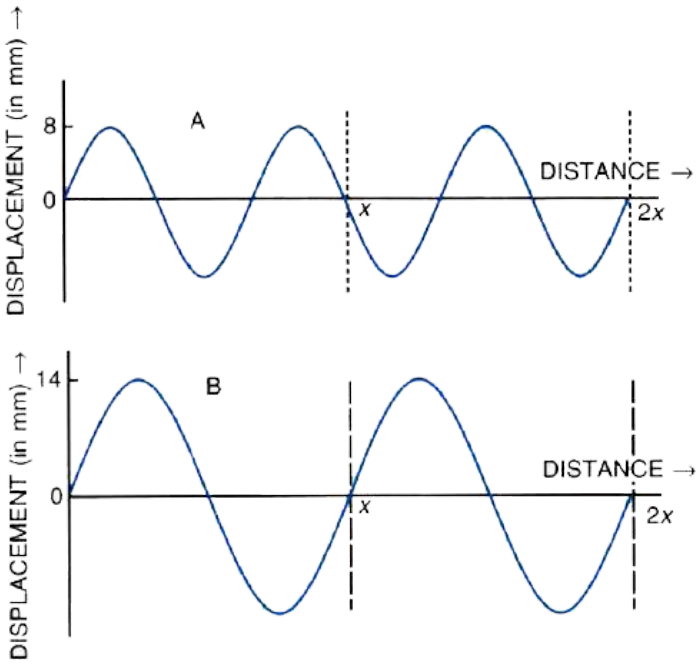
27. In Fig. , A and B represent the displacement distance graphs for two sound waves when they pass through air.



What is the relation between their

velocities

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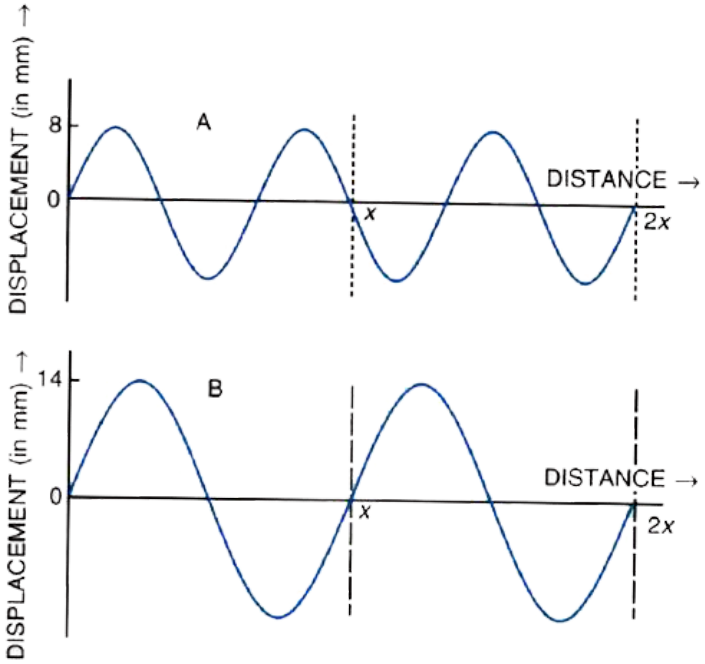

What is the relation between their wavelengths

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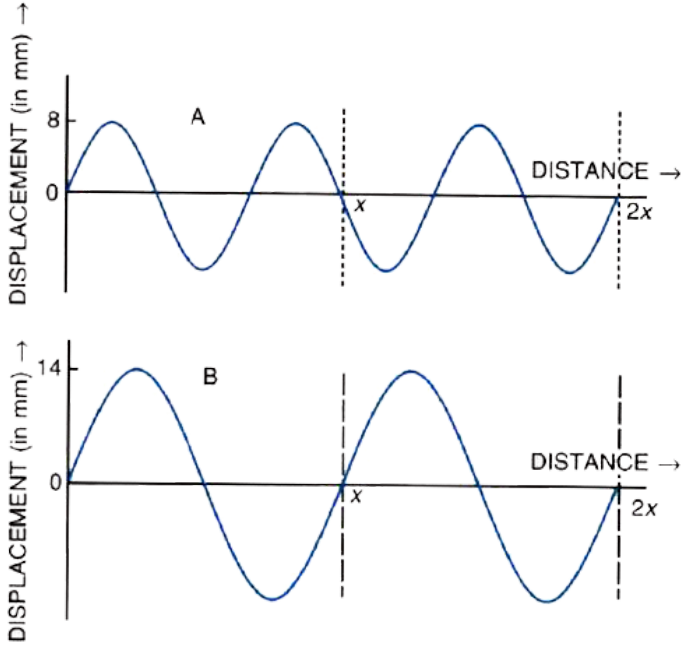
29. In Fig. , A and B represent the displacement distance graphs for two sound waves when they pass through air.



What is the relation between their

pitch

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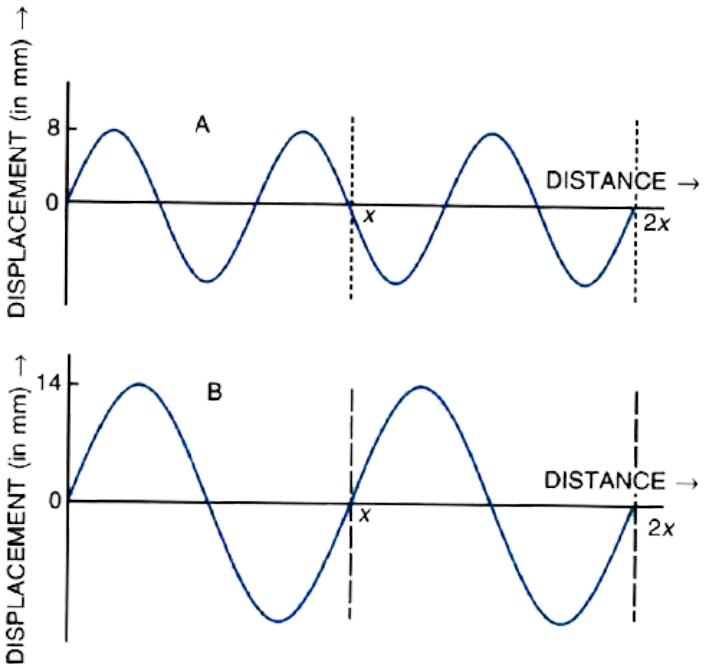
30. In Fig. , A and B represent the displacement distance graphs for two sound waves when they pass through air.



What is the relation between their

loudness

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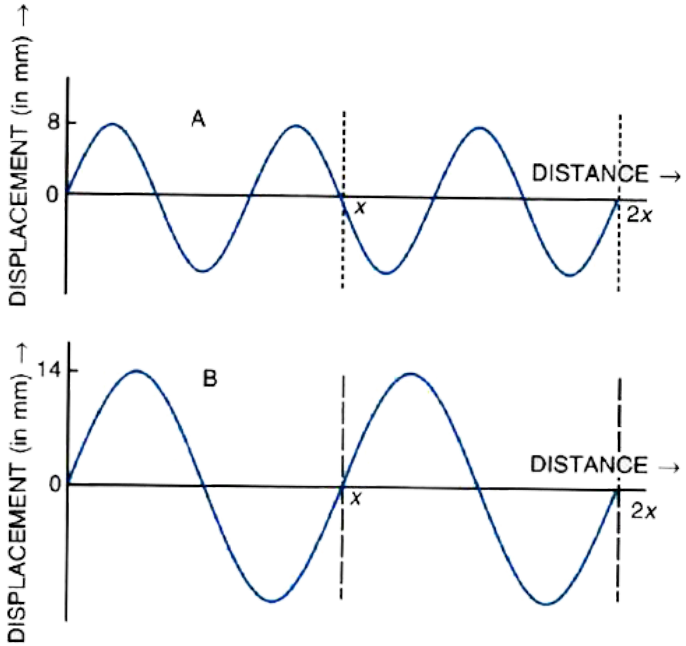
31. In Fig. , A and B represent the displacement distance graphs for two sound waves when they pass through air.



How do they differ in quality ?

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32. A certain sound has a frequency of 256 hertz and a wavelength of 1.3 m.

(a) Calculate the speed with which this sound travels.

(b)What difference would be felt by a listener between the above sound and another sound travelling at the same speed, but of wavelength 2.6 m?

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(a) Calculate the speed with which this sound travels.

(b)What difference would be felt by a listener between the above sound and another sound travelling at the same speed, but of wavelength 2.6 m?

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34. The ratio of amplitudes of two waves is 3 : 4. Find the ratio of their

loudness

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35. The ratio of amplitudes of two waves is 3 : 4. Find the ratio of their

pitch

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Exercise 7 A

1. What are mechanical waves ?

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2. Define the following terms in relation to a wave :

amplitude

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3. Define the following terms in relation to a wave :

frequency

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4. Define the following terms in relation to a wave :

wavelength

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5. Define the following terms in relation to a wave :

wave velocity.

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6. A wave passes from one medium to another medium. Mention one property of the wave out of speed, frequency or wavelength

which changes

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7. A wave passes from one medium to another medium. Mention one property of the wave out of speed, frequency or wavelength which does not change.

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8. State two factors on which the speed of a wave travelling in a medium depends.

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9. State two differences between light and sound waves.

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10. What do you mean by reflection of sound ? State one condition for the reflecton of a sound wave. Name a device in which reflection of sound wave is used.

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11. What is meant by an echo ? State two conditions necessary for an echo to be heard distinctly.

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12. A man is standing at a distance of 12 m from a cliff. Will he be able to hear a clear echo of his sound? Give a reason for your answer.

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13. State two applications of echo.

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14. Explain how the speed of sound can be determined by the method of echo.

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15. State the use of echo by a bat, dolphin and fisherman.

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16. How do bats avoid obstacles in their way, when in flight?

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17. What is meant by sound ranging ? Give one use of sound ranging,

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18. Name the waves used for sound ranging. State one reason for their use. Why are the waves mentioned by you not audible to us?

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19. What is the principle on which SONAR is based ?

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20. State the use of echo in medical field.

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Exercise 7 A Multiple Choice Type

1. What minimum distance is required between the source of sound and the reflecting surface to hear an echo ? Give reason.

A. 10 m

B. 17 m

C. 34 m

D. 50 m

Answer:

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2. To detect obstacles in their path, bats produce

A. infrasonic waves

B. ultrasonic waves

C. electromagnetic waves

D. radio waves.

Answer:

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Exercise 7 A Numericals

1. The wavelength of waves produced on the surface of water is 20 cm. If the wave velocity

is 24 ms^{-1}, calculate

The number of waves produced in one second

and

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2. The wavelength of waves produced on the surface of water is 20 cm. If the wave velocity is 24 ms^{-1}, calculate

The time required to produce a wave.

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3. Calculate the minimum distance in air required between the source of sound and the obstacle to hear an echo. Take speed of sound in air = 350 ms^{-1}

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4. What should be the minimum distance between the source and reflector in water so that the echo is heard distinctly ? (The speed of sound in water = 1400 m s^{-1}).

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5. A man standing 25 m away from a wall produces a sound and receives the reflected sound.

Calculate the time after which he receives the reflected sound if the speed of sound in air is 350 m s^{-1}.

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6. A man standing 25 m away from a wall produces a sound and receives the reflected sound.

Will the man be able to hear a distinct echo ?

Give a reason for your answer.

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7. A RADAR sends a signal to an aeroplane at a distance 300 km away, with a speed of $3 \times 10^8 ms^{-1}$. After how much time is the

signal received back after reflecting from the aeroplane ?

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8. A man standing 48 m away from a wall fires a gun. Calculate the time after which an echo is heard. (The speed of sound in air is 320 m s^{-1}).

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9. A ship on the surface of water sends a signal and receives it back from a submarine inside water after 4 s. Calculate the distance of the submarine from the ship. (The speed of sound in water is 1450 m s^{-1}).

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10. A pendulum has a frequency of 5 vibrations per second. An observer starts the pendulum and fires a gun simultaneously. He hears echo

from the cliff after 8 vibrations of the pendulum. If the velocity of sound in air is 340 m s^{-1}, find the distance between the cliff and the observer.

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11. A person standing between two vertical cliffs produces a sound. Two successive echoes are heard at 4 s and 6 s. Calculate the distance between the cliffs. (Speed of sound in air = 320 m s^{-1})

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12. A person standing at a distance x in front of a cliff fires a gun. Another person B standing behind the person A at distance y from the cliff hears two sounds of the fired shot after 2s and 3s respectively. Calculate x and y (take speed of sound 320 ms^{-1}).

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13. An ultrasonic wave is sent from a ship towards the bottom of the sea. It is found that the time interval between the sending and the receiving of the wave is 1.5 s. Calculate the depth of the sea, , if the velocity of sound in sea water is $1400ms^{-1}$.

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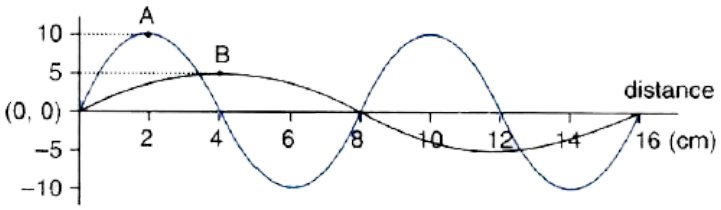
14. Figure below shows the distance-displacement graph of two waves A and B.

Compare (i) the amplitude, (ii) the wavelength of the two waves.



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Exercise 7 B

1. What do you understand by natural vibrations of a body? Give one example.

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2. What is meant by the natural frequency of vibrations of a body ? Name one factor on which it depends

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3. Draw a graph between displacement and time for a body executing natural vibrations.

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4. Where can a body execute natural vibrations?

Watch Video Solution

5. Where can a body execute natural vibrations?

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6. Name one factor which affects the frequency of sound emitted due to vibrations in an air column.

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7. How does the frequency depend on the factor stated in part (a).

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8. State one way of increasing the frequency of a note produced by an air column.

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9. State two ways by which the frequency of a note given out by a stretched vibrating string can be increased.

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10. How is the frequency of a stretched string related to:

Its length?

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11. How is the frequency of a stretched string related to:

Its tension?

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12. What adjustments would you make for tuning a stringed instrument for it to emit a note of a desired frequency?

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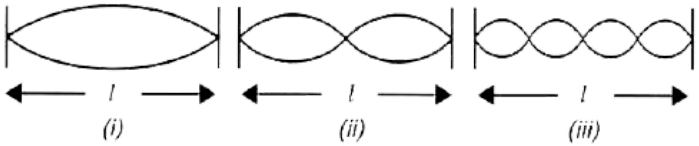
13. The diagram in Fig. shows three ways in which a string of length I in an instrument can vibrate.



Which of the diagram shows the principal note?

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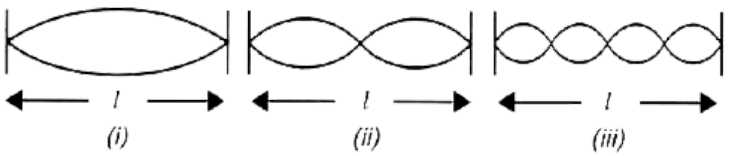

Which vibration has a frequency four times that of the first?

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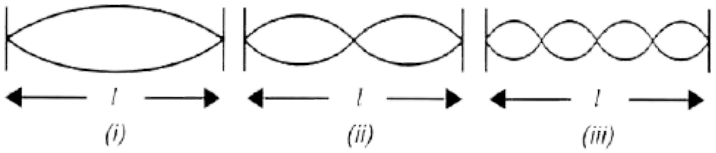

Which vibration is of the longest wavelength ?

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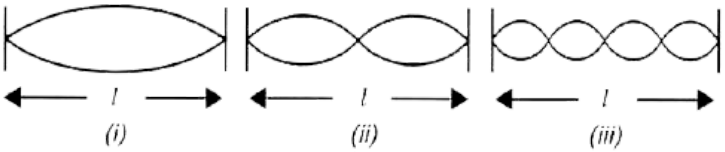
16. The diagram in Fig. shows three ways in which a string of length I in an instrument can vibrate.



What is the ratio of frequency of vibrations in diagrams (i) and (ii) ?

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17. Explain why strings of different thickness are provided on a stringed instrument.

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18. A blade, fixed at one end, is made to vibrate by pressing its other end and then releasing it. State one way in which the frequency of vibrations of the blade can be lowered.

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19. How does the medium affect the amplitude of the natural vibrations of a body?

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20. What are damped vibrations ? How do they differ from free vibrations ? Give one example of each.

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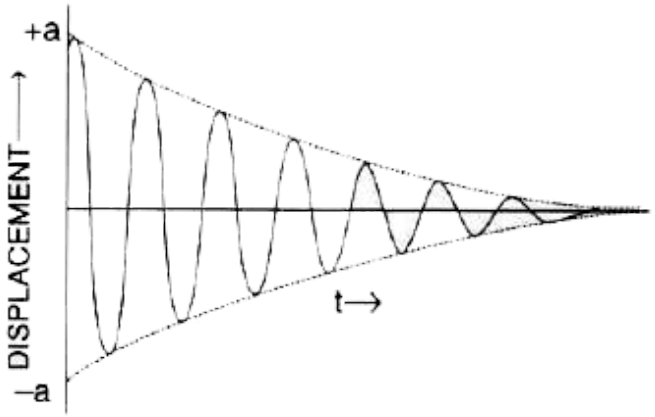
21. The diagram in Fig. shows the displacement time graph of a vibrating body.



Name the kind of vibrations.

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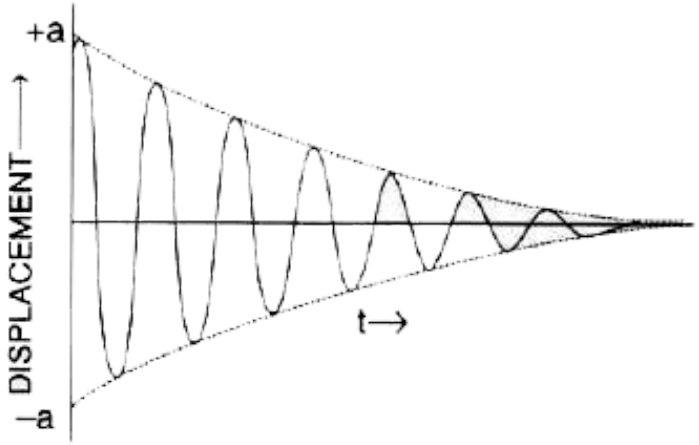
22. The diagram in Fig. shows the displacement time graph of a vibrating body.



Give one example of such vibrations.

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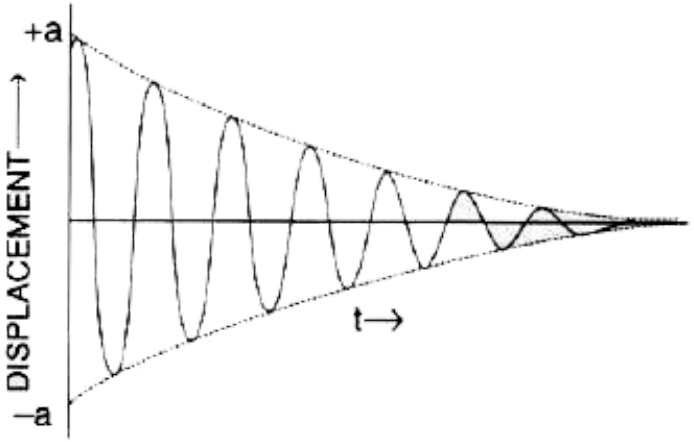
23. The diagram in Fig. shows the displacement time graph of a vibrating body.



Why is the amplitude of vibrations gradually decreasing ?

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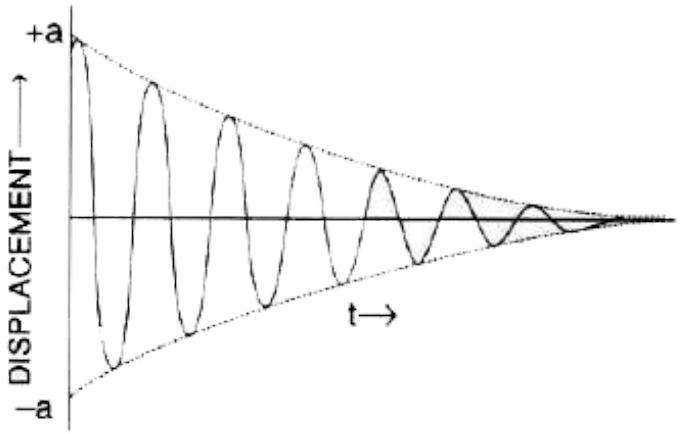
24. The diagram in Fig. shows the displacement time graph of a vibrating body.



What happens to the vibrations of the body after some time?

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25. A tuning fork is vibrating in air. State whether the vibrations are natural or damped ?

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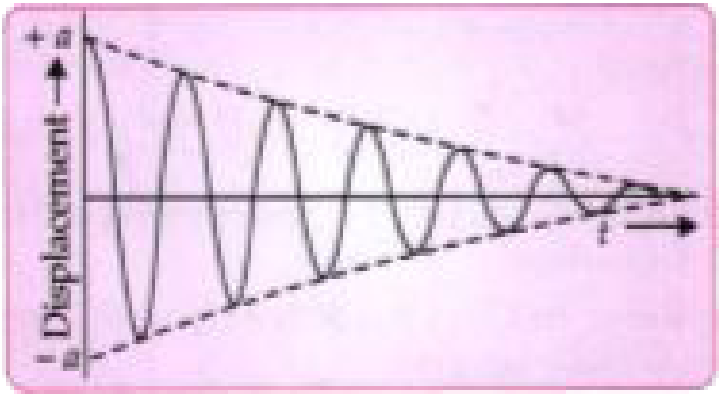
26. The diagram below shows the displacement-time graph for a vibrating body. Name the type of vibrations produced by the

vibrating body.



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27. What are forced vibrations ? Give one example to illustrate your answer.

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28. When the stem of a vibrating tuning fork is gently pressed on the surface of a table louder sound is heard. Why?

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29. State two differences between natural and forced vibrations.

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30. What is meant by Resonance ?

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31. State the condition for the resonance to occur.

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32. Complete the following sentence : Resonance is a special case of ..... vibrations, when frequency of the driving force is ..... natural frequency of the driven body.

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33. State two differences between the forced and resonant vibrations.

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34. Why is a loud sound heard at resonance ?

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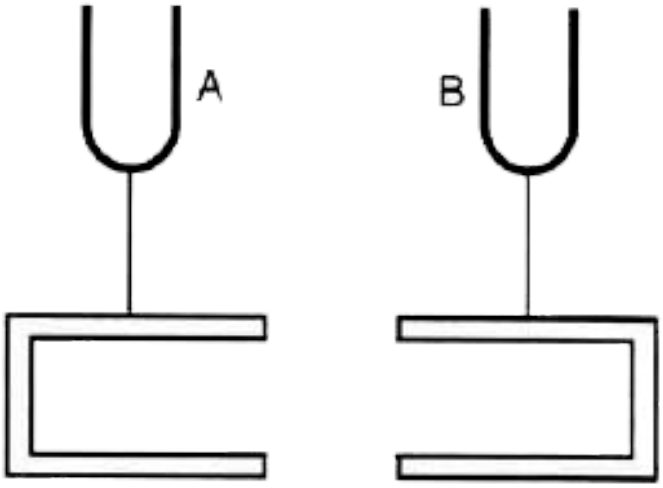
35. Fig. shows two tuning forks A and B of the same frequency mounted on two separate sound boxes with their open ends facing each other. The fork A is set into vibration. (a) Describe your observation. (b) State the principle illustrated by this experiment.



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36. A vibrating tuning fork, held over an air column of a given length with its one end closed, produces a loud audible sound. Name the phenomenon responsible for it and explain the observation.

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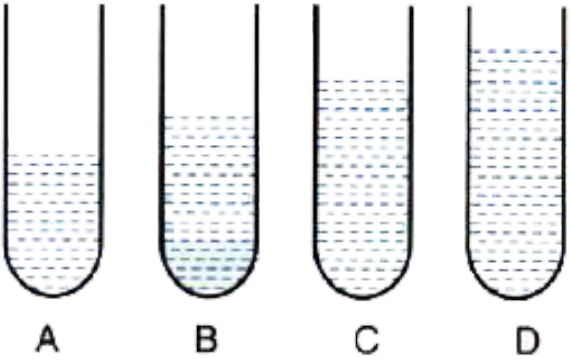
37. In Fig. , A, B, C and D represent the test tubes each of height 20 cm which are filled

with water up to heights of 12 cm, 14 cm, 16 cm and 18 cm respectively. If a vibrating tuning fork is placed over the mouth of test tube D, a loud sound is heard.



Describe the observations with the tubes A, B and C when the vibrating tuning fork is placed over the mouth of these tubes.

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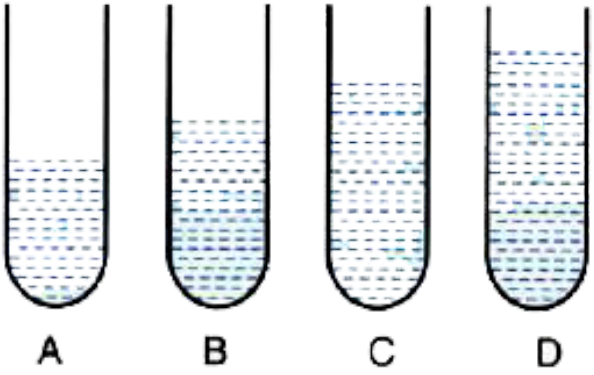
38. In Fig. , A, B, C and D represent the test tubes each of height 20 cm which are filled with water up to heights of 12 cm, 14 cm, 16 cm and 18 cm respectively. If a vibrating tuning fork is placed over the mouth of test tube D, a loud sound is heard.



Give the reason for your observation in each tube.

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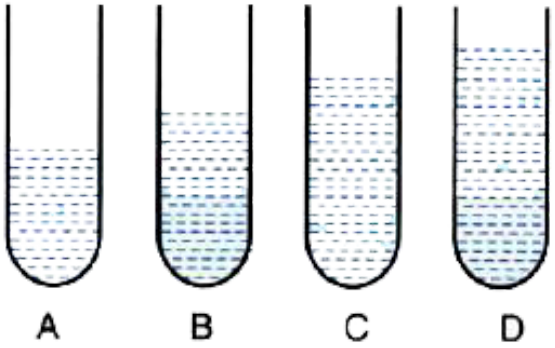
39. In Fig. , A, B, C and D represent the test tubes each of height 20 cm which are filled with water up to heights of 12 cm, 14 cm, 16 cm and 18 cm respectively. If a vibrating tuning fork is placed over the mouth of test tube D, a loud sound is heard.



State the principle illustrated by the above experiment.

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40. Marching soldiers are asked to break their steps while crossing a bridge. Why?

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41. Explain, why stringed musical instruments, like the guitar, are provided with a hollow box

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42. How do you tune your radio set to a particular station ? Name the phenomenon involved in doing so and define it.

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Exercise 7 B Multiple Choice Type

1. What are the frequencies heard when a stretched wire is plucked in the middle ?

A. resonant vibrations

B. natural vibrations

C. damped vibrations

D. forced vibrations.

Answer: B

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2. When a body vibrates under a periodic force, the vibrations of the body are :

A. natural vibrations

B. damped vibrations

C. forced vibrations

D. resonant vibrations.

Answer: C

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Exercise 7 C

1. State three characteristics of musical sound.

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2. Which of the following quantity determines the loudness of a sound wave ? (i) wavelength, (ii) frequency, and (iii) amplitude.

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3. How is loudness related to the amplitude?

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4. If the amplitude of a wave is doubled, what will be the effect on its loudness ?

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5. Two waves of the same pitch have amplitudes in the ratio 1:3. What will be the

ratio of their

loudness

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6. Two waves of the same pitch have amplitudes in the ratio 1 : 3. What will be the ratio of their :

frequencies?

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7. How does the wave pattern of a loud note differ from that of a soft note ?

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8. In which units is the loudness of sound measured?

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9. Why is the loudness of the sound heard by a plucked wire increased when it is mounted on a sound board ?

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10. Define the term intensity of a sound wave. State the unit in which it is measured.

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11. How is loudness of sound related to the intensity of wave producing it?

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12. Comment on the statement 'loudness of sound is of subjective nature, while intensity is of objective nature.

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13. State three factors which affect the loundess of a sound heard by a listener.

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14. The outer case of the bell in a temple is made big. Give a reason.

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15. Name the unit used for measuring the sound level.

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16. State the safe limit of sound level in terms of decibel for human hearing.

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17. What is meant by noise pollution? Name one source of sound causing noise pollution.

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18. State one factor which determine pitch of sound.

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19. Name the subjective property of sound related to its frequency

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20. Name and define the characteristic which enables one to distinguish two sounds of the same loudness, but of different frequencies, given by the same instrument.

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21. Draw a diagram to show the wave pattern of a pitch note and a low pitch note, but of the same loudness.

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22. How is it possible to detect the filling of a bottle under a water tap by hearing the sound at a distance ?

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23. The frequencies of notes given by flute, guitar and trumpet are respectively 400 Hz, 200 Hz and 500 Hz. Which one of these has the highest pitch ?

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24. Complete the following sentences :

The pitch of sound increases if its frequency .....

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25. Complete the following sentences :

If the amplitude of a sound is halfed, its loudness becomes

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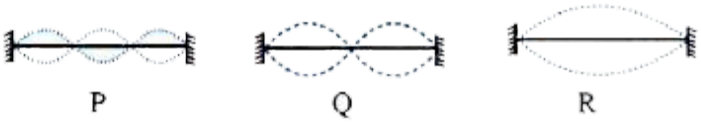
26. The diagram below shows three different modes of vibration P, Q and R of the same string of a given length.



Which vibration will produce a louder sound and why?

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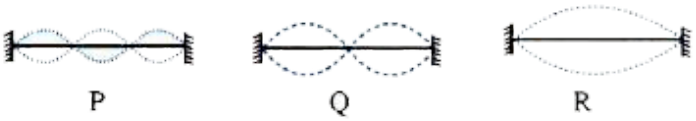
27. The diagram below shows three different modes of vibration P, Q and R of the same string of a given length.



Which vibration will produce a sound of maximum shrillness (or pitch) and why?

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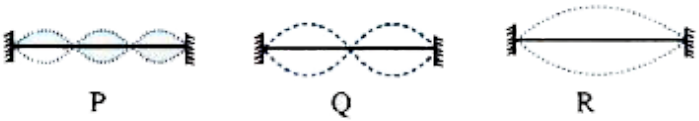
28. The diagram below shows three different modes of vibration P, Q and R of the same string of a given length.



What is the ratio of the wavelength of vibrations P and R?

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29. Name the characteristic which differentiates two sounds of the same pitch and same loudness.

Watch Video Solution

30. How does the two sounds of same loudness and same pitch produced by different instruments differ ? Draw diagrams to illustrate your answer.

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31. Two identical guitars are played by two persons to give notes of the same loudness and pitch. Will they differ in quality ? Give a reason for your answer.

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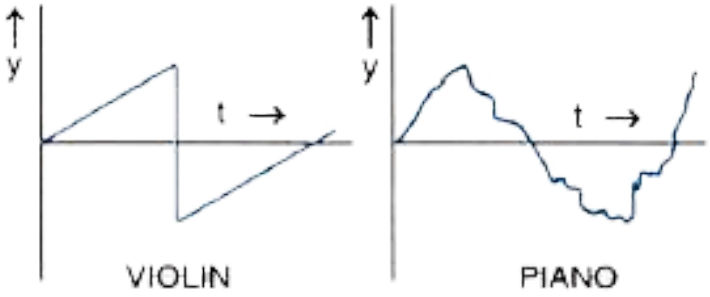
32. Two musical notes of the same pitch and same loudness are played on two different instruments. Their wave patterns are shown in Fig.



Explain why are the wave patterns different.

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33. Which characteristic of sound, makes it possible to recognize a person by his voice without seeing him ?

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34. State one factor which determine pitch of sound.

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35. The loudness of a sound depends upon the

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36. Name the quantity which determines loudness, pitch and quality of a sound.

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37. What characteristics of sound would change if there is a change in its :

Amplitude

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38. Which characteristics of sound will change if there is a change in

its waveform.

Watch Video Solution

39. Name the characterstic of sound affected due to a change in its

frequency

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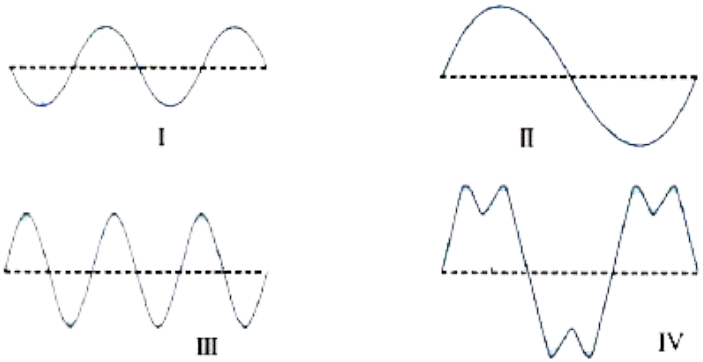
40. Sketches I to IV in Fig. show sound waves, all formed in the same time interval.



Which diagram shows

a note from a musical instrument,

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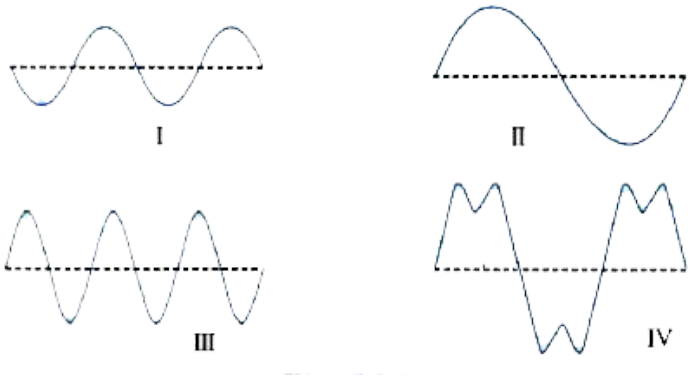
41. Sketches I to IV in Fig. show sound waves,

all formed in the same time interval.



Which diagram shows

a soft (or feeble) note,

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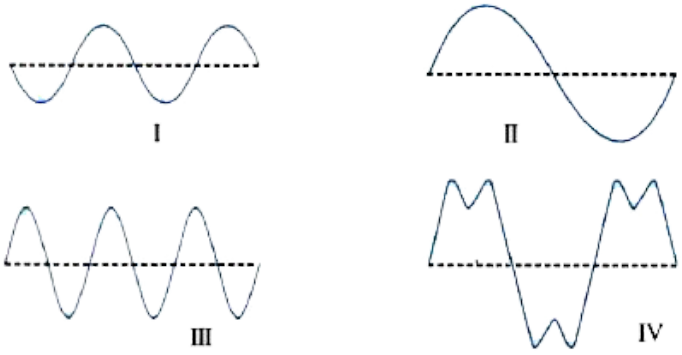
42. Sketches I to IV in Fig. show sound waves,

all formed in the same time interval.



Which diagram shows

a bass (or low frequency) note.

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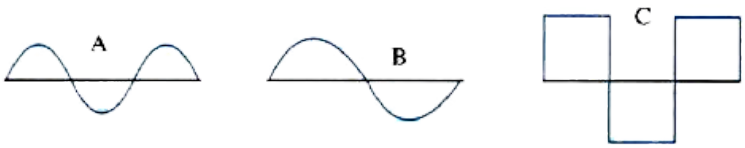
43. Fig. shows wave patterns of three sounds A, B and C. Name the characteristic of sound which is the same between (i) A and B, (ii) B

and C, and (iii) C and A.



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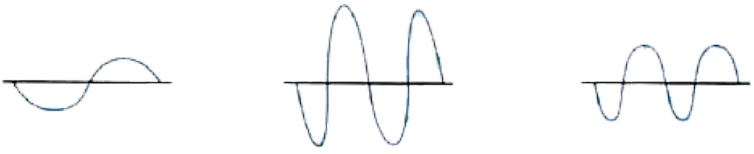
44. A microphone is connected to the Y-input of a C.R.O. Three different sounds are made in turn in front of the microphone. Their traces (a), (b) and (c) produced on the screen are shown in Fig.



Which trace is due to the loudest sound ? Give reason for your answer.

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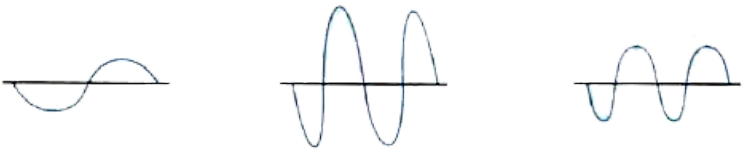
45. A microphone is connected to the Y-input of a C.R.O. Three different sounds are made in turn in front of the microphone. Their traces (a), (b) and (c) produced on the screen are shown in Fig.



Which trace is due to the sound with the lowest pitch ? Explain your answer.

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46. In what respect does the wave pattern of noise and music differ ? Draw diagrams to explain your answer.

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47. State one difference between a musical note and noise.

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Exercise 7 C Multiple Choice Type

1. By reducing the amplitude of a sound wave, its :

A. pitch increases

B. loudness decreases

C. loudness increases

D. pitch decreases.

Answer: B

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2. Two sounds of same loudness and same pitch produced by two different instruments differ in their :

A. amplitudes

B. frequencies

C. wave forms

D. all the above.

Answer: C

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3. Two sounds A and B are of same amplitudes, same wave forms but of frequencies f and 2f respectively. Then :

A. B differ in quality from A

B. B is grave, A is shrill

C. B is shrill, A is grave

D. B is louder than A.

Answer: C

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Theory Based Mcq

1. Sound waves are waves that are produced due to .....

A. disturbance of particles

B. turbulence of particles

C. vibrations of particles

D. all of the above.

Answer: D

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2. Sound travels in the form of .....

A. compression and rarefactions

B. crest

C. trough

D. all of the above

Answer: D

Watch Video Solution

3. Velocity of sound is constant in .....

A. all mediums

B. homogeneous medium

C. heterogeneous medium

D. vacuum

Answer: B

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4. Why will an echo not be heard when the distance between the source of sound and the reflecting surface is 10 m ?

A. 10m

B. 17m

C. greater than 17m

D. 34m

Answer: C

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Application Based Mcq

1. SONAR is a technique used to .....

A. detect the submarine inside sea

B. determine the size of blue whale

C. detect the impurities present in sea water

D. detect the depth of sea bed

Answer: D

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2. Bats can catch their prey by using the principle of .....

A. reflection of sound

B. refraction of sound

C. concept of echo

D. both (a) and (c)

Answer: D

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3. Modern super sonic war planes use the principle of ..... while detecting their targets.

A. echo

B. SONAR

C. reverberation

D. None of these

Answer: A

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4. The spread of a glacier in the artic region can be judged by a submarine by using the principle of

A. repetition of sound

B. reflection of sound

C. reflection of sound

D. none of the above

Answer: B

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5. The repetition of sound heard in a cave or empty room is a case of .....

A. echo

B. superposition

C. interpolation

D. reverberation

Answer: D

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6. Amphitheaters and auditorium walls are fitted with ..... To avoid the echoing of sound.

A. granite

B. Italian marble

C. sound absorbers such as foam board

D. wooden wall

Answer: C

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Numerical Based Mcq

1. A person standing between two cliffs hears two echo one after 3s and another after 4 sec, so time taken for first echo s ..... and that for second echo is .....

A. 3s, 4s

B. 3s, 1s

C. 3s, 7s

D. 7s, 7s

Answer: A

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2. A person standing in front of a vertical cliff whistles. he later moves towards the cliff by travelling a istance of 300m. at first, he hears the sound after 4 s and hen on travelling the distance he hears the echo after 9 sec. Time take for first echo is ..... and time for the second echo is .....

A. 4s, 5s

B. 5s, 4s

C. 4s, 9s

D. 9s, 4s

Answer: C

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3. A person standing between two vertical cliff hears two sounds one after 6s and other 4s

later. The time for first echo is ..... And for second echo is .....

A. 6s, 4s

B. 4s, 6s

C. 6s, 10s

D. 10s, 4s

Answer: C

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4. A man stands between two high rise buildings and blows a whistle. He hears two successive echoes one after 0.4 ond other after 1.6sec. Calculate the distance between the two buildings. (given velocity of sound in air = $332ms^{-1}$]

A. 320m

B. 332m

C. 340m

D. 350m

Answer: B

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5. A man stands in between two vertical cliffs X and Y such that he is at a distance of 660 m from X. When he explodes cracker, he hears the first echo after 4 sec and second echo 6 second later. Calculate the speed of sound in air and the distance of cliff y from the man.

A. $330ms^{-1}, 1650m$

B. $320ms^{-1}$,1400m

C. $340ms^{-1}$, 1700m

D. none of these

Answer: A

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Diagram Based Mcq

1. Name the machine seen in the figure using the principle of echo.

A. sonography

B. electro cardiogram

C. echo cardiogram

D. intra venous machine

Answer: C

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2. Bats use this technique to detect their prey and hunt them.

A. flapping their wings

B. echo

C. reflection of sound waves

D. both (a) and (c)

Answer: D

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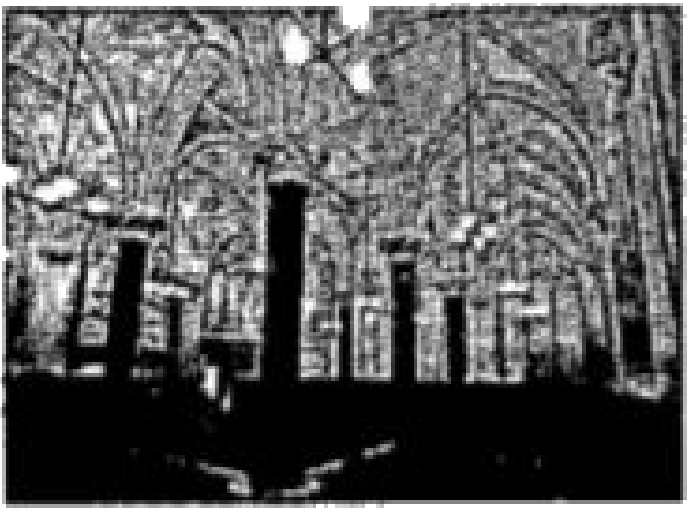
3. Can an echo be heard in huge cathedrals and churches as shown in the figure ?



A. Yes

B. No

C. insufficient data

D. none of these

Answer: C

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