PHYSICS

BOOKS - ICSE

PROPAGATION OF SOUND WAVES

Examples

1. A bat can hear sound of frequencies up to 120 kHz. Determine the minimum wavelength

of sound which it can hear. Take speed of sound in air to be 344 ms^{-1}

2. Ocean waves of time period 10 s have wave velocity 15 ms^{-1}. Find the wavelength of these waves .

3. Ocean waves of time period 10 s have wave velocity 15 ms^{-1}. Find : the horizontal distance between a wave crest and its adjoining wave trough.

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4. A wave pulse of frequency 200 Hz, on a string moves a distance 8 m in 0.05 s. Calculate the velocity of pulse .

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5. A wave pulse of frequency 200 Hz, on a string moves a distance 8 m in 0.05 s. Calculate the wavelength of wave on string.

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6. Compare approximately the speed of sound in air and steel.

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7. The smoke from the gun barrel is seen 2 second before the explosion is heard. If the speed of sound in air is 340 ms^{-1}, calculate the distance of observer from gun. State the approximation used.

8. The speed of sound in air is 330 ms^{-1} and in water is 1650 ms^{-1}. It takes 2 s for sound to reach a certain distance from the source placed in air. Find the distance.

9. The speed of sound in air is 330 ms^{-1} and in water is 1650 ms^{-1}. It takes 2 s for sound to reach a certain distance from the source placed in air. How much time will it take for sound to reach the same distance when the source is in water ?

Exercise 8 A

1. What causes sound ?

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2. What is sound ? How is it produced ?

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3. Complete the following sentence :

Sound is produced by a …………. body.

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4. Describe a simple experiment which demonstrates that the sound produced by a tuning fork is due to vibrations of its arms.

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5. Describe in brief, with the aid of a labelled diagram, an experiment to demonstrate that a material medium is necessary for the propagation of sound.

6. There is no atmosphere on moon. Can you hear each other on the moon's surface ?

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7. State three characteristics of the medium required for propagation of sound ?

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8. Explain with an example, the propagation of sound in a medium.

9. Choose the correct word/words to complete the following sentence :

When sound travels in a medium ...... (the particles of the medium, the source, the disturbance, the medium) travels in form of a wave.

10. Name the two kinds of waves in form of which sound travels in a medium.

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11. What is a longitudinal wave ? In which medium: solid, liquid or gas, can it be produced ?

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12. What is a transverse wave ? In which medium: solid, liquid or gas, can it be produced ?

13. Explain the meaning of terms compression and rarefaction in relation to a longitudnal wave.

14. Explain the terms crest and trough in relation to a transverse wave.

15. Describe an experiment to show that in wave motion, only energy is transferred, but particles of medium do not leave their positions.

16. Define the term amplitude of a wave. Write its S.I. unit.

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17. What do you mean by the term frequency of a wave ? State its S.I. unit.

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18. How is the frequency of a wave related to its time period ?

19. Define the term wave velocity. Write its S.I. unit.

20. Draw displacement-time graph of a wave and show on it the amplitude and time period of wave.

21. Draw a displacement-distance graph of a wave and mark on it, the amplitude of wave by the letter a and wavelength of wave by the letter λ

22. How are the wave velocity V, frequency f and wavelength λ of a wave related ? Derive the relationship.

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23. State two properties of the medium on which the speed of sound in it depends.

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24. Arrange the speed of sound in gases V_g, solids V_s and liquids V_l in an ascending order.

25. State the speed of light

26. State the speed of sound in air ?

27. Compare approximately the speed of sound in air, water and steel

28. Answer the following: Can sound travel in vacuum ?

29. Answer the following: How does the speed of sound differ in different media ?

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30. Flash of lightning reaches us earlier than the sound of thunder. Explain the reason.

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31. If you place your ear close to an iron railing which is tapped some distance away, you hear the sound twice. Explain why?

32. The sound of an explosion on the surface of a lake is heard by a boat man 100 m away and by a diver 100 m below the point of explosion.

(i) Who would hear the sound first : boat man

or diver?

(ii) Give a reason for your answer in part (1).

(iii) If sound takes time to reach the boat man, how much time approximately does it take to reach the diver?

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33. How do the following factors affect, if at all, the speed of sound in air : frequency of sound

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34. How do the following factors affect, if at all, the speed of sound in air:

Temperature of air

35. How do the following factors affect, if at all, the speed of sound in air : pressure of air

36. How do the following factors affect, if at all, the speed of sound in air : moisture in air?

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37. How does the speed of sound change with change in amplitude .

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38. How does the speed of sound change with change in wavelength of sound wave ?

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39. In which medium the speed of sound is more : humid air or dry air ? Give a reason to your answer.

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40. How does the speed of sound in air vary

with temperature ?

41. Describe a simple experiment to determine

the speed of sound in air. What approximation

is made in the method described by you ?

42. Complete the following sentence :

Sound can not travel through ....,but it requires a ....

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43. Complete the following sentence :

When sound travels in a medium, the particles of medium .... but the disturbance

....

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44. Complete the following sentence :

A longitudinal wave is composed of compression and ....

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45. Complete the following sentence :

A transverse wave is composed of crest and

....

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46. Complete the following sentence :

Wave velocity = ... $\times$ wavelength.

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Exercise 8 A Multiple Choice Type

1. The correct statement is :

A. Sound and light both require medium

for propagation

B. Sound can travel in vacuum, but light can not

C. Sound needs medium, but light does not need medium for its propagation

D. Sound and light both can travel in vacuum.

Answer: C

2. The speed of sound in air at $0°C$ is nearly :

A. $1450ms^{-1}$

B. $450ms^{-1}$

C. $5100ms^{-1}$

D. $330ms^{-1}$

Answer: D

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3. Sound in air propagates in form of:

    A. longitudinal wave

    B. transverse wave

    C. both longitudinal and transverse waves

    D. neither   longitudinal   nor   transverse

     wave.

Answer: A

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4. The speed of light in air is :

A. $3 \times 10^8 ms^{-1}$

B. $330 ms^{-1}$

C. $5100 ms^{-1}$

D. $3 \times 10^{10} ms^{-1}$

Answer: A

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Exercise 8 A Numericals

1. The heart of a man beats 75 times a minute.

What is its (a) frequency ?

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2. The heart of a man beats 75 times a minute.

What is its time period?

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3. The time period of a simple pendulum is 2 s. Find its frequency .

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4. The separation between two consecutive crests in a transverse wave is 100 m. If wave velocity is 20 m s^{-1}, find the frequency of wave.

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5. A longitudinal wave travels at a speed of 0.3 m s^{-1} and the frequency of wave is 20 Hz. Find the separation between the two consecutive compressions.

6. A source of wave produces 40 crests and 40 troughs in 0.4 s. What is the frequency of the wave ?

7. An observer A fires a gun and another observer B at a distance 1650 m away from A hears its sound. If the speed of sound is 330 m s^{-1}, find the time when B will hear the sound after firing by A.

8. The time interval between a lightning flash and the first sound of thunder is 5 s. If the

speed of sound in air is 330 m s^{-1}, find the distance of flash from the observer.

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9. A boy fires a gun and another boy at a distance hears the sound of fire 2.5 s after seeing the flash. If speed of sound in air is 340 m s^{-1}, find the distance between the boys.

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10. An observer sitting in line of two tanks, watches the flashes of two tanks firing at each other at the same time, but he hears the sounds of two shots 2 s and 3.5 s after seeing the flashes. If distance between the two tanks is 510 m, find the speed of sound.

11. How long will sound take to travel in (a) an iron rail and (b) air, both 3.3 km in length ?

Take speed of sound in air to be 330 m s^{-1} and in iron to be 5280 m s^{-1}.

12. Assuming the speed of sound in air equal to 340 ms^{-1} and in water equal to 1360 m s^{-1}, find the time taken to travel a distance 1700 m by sound in air .

13. Assuming the speed of sound in air equal to 340 ms^{-1} and in water equal to 1360 ms^{-1}, find the time taken to travel a distance 1700 m by sound in water.

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Exercise 8 B

1. What do you mean by the audible range of frequency?

2. Write the audible range of frequency for the

normal human ear.

3. For which range of frequencies, human ears

are most sensitive ?

4. Which has the higher frequency - ultrasonic sound or infrasonic sound?

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5. We can hear sounds of frequency in the range of ....

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6. Complete the following sentence :

Ultrasound is of frequency ....

7. Complete the following sentence :

Infrasonic sound is of frequency ....

8. Complete the following sentence :

Bats can produce and hear .... sound.

9. Complete the following sentence :

Elephants produce .... sound.

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10. Name the sounds of the frequencies given below:

10 Hz

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11. Name the sounds of the frequencies given below:

100 Hz

12. Name the sounds of the frequencies given below:

1000 Hz

13. Name the sounds of the frequencies given below:

40 Hz

14. Can you hear the sound produced due to vibrations of a seconds' pendulum ? Give reason.

15. What is ultrasound ?

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16. State the approximate speed of ultrasound in air.

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17. The properties of ultrasound that make it useful, are

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18. Explain how do bats locate the obstacles and prey in their way.

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19. State two applications of ultrasound.

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Exercise 8 B Multiple Choice Type

1. A man can hear the sound of frequency:

A. 1 Hz

B. 1000 Hz

C. 200 Hz

D. 5 MHz

Answer: B

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2. The properties of ultrasound that make it useful, are

    A. high power and high speed

    B. high power and good directivity

    C. high frequency and high speed

    D. high frequency and bending around the

       objects.

Answer: B

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3. Sonar makes use of :

A. infrasonic sound

B. ultrasound

C. ordinary sound

D. light

Answer: B