

Introduction

In our daily life, we hear sound everywhere. We hear sounds from many different sources like humans, birds, bells, machines, vehicles, televisions, radios etc. Sound produces a sensation of hearing in our ears. Sound is produced due to vibrations and it helps us to communicate with one another.

In this chapter we discuss the properties of sound waves, their propagation and their production by vibrating systems.

Sound is Produced by a Vibrating Body

The rapid to-and-fro motion of an object is called vibration. When we vibrate a tightly stretched string, it vibrates about its central position and produces sound. When the string goes from upward extreme position to downward extreme position and come back to its upward extreme position, then it is called one vibration. When the string stops vibrating, it does not produce any sound.



The rapid to-and-fro movement of a rubber band produces sound.

Sound is produced not only by vibrations in strings but also by vibrations in stretched skins or membranes, as well as by vibrations in air columns.

Sound Produced by Humans

The sound in the humans is produced by voice box or larynx. The larynx has two vocal cords, which are stretched across the voice box such that a passage of air remain between the cords. When we speak, the air passes through the opening and cords starts vibrating to produce sound.

The frequency of sound produced by men is lower than the frequency of sound of women and children because women have shorter vocal cords than men. Children have very short vocal cords.



Wind pipe Vibration of the vocal cords produce sound.

Sound Needs a Medium for Propagation

Sound travels through a medium. It may be gas, liquid or solid. It cannot travel through vacuum. So, we find that sound needs a medium to travel. The speed of sound is different in different medium. The speed of sound depends on temperature, nature of the material and on the physical state of the material.

The speed of sound in different medium at normal temperature is given below :

	Substance (20°C)	Speed of Sound (m/s)
1.	Air	343
2.	Water	1482
3.	Sea water at 3.5% salinity	1522
4.	Aluminium	6420
5.	Granite	6000

Table: Speed of sound in different media

To show that sound can travel through a solid medium.



Sound can travel through solids

Keep one of your ears against one end of your desk. Close the

other ear firmly with the palm of your hand. Tell a friend to tap the desk at the other end with his hand. Can you hear the tapping sound? Is it loud or soft?

Do this experiment in a tub filled with water. Hold a bell in one hand and dip it in water. Keep one of your ears (caution : water should not enter your ear) gently on the surface of water and ring the bell inside the water. Can you hear the bell? What does this show ?



ACTIVITY

CORNER

Sound can travel through liquids



- On the moon, there is no atmosphere. Therefore sound cannot be heard on moon.
 - Sound travels 16 times faster in metals and four times faster in water than in air.

Perception of Sound

Sound is perceived by the ears. The human ear has three main parts :

- (i) **Outer Ear :** It consists of pinna and the ear tube. At the end of the eartube, there is a stretched membrane which is called eardrum. The sound waves passes through eartube to vibrate eardrum.
- (ii) **Middle Ear :** It has three small bones which are interlinked together and attached to the eardrum and the inner ear. These bones receive vibration through the eardrum and pass them to the inner ear.
- (iii) **Inner Ear :** It consists of a coiled organ of hearing, semicircular canals, which are organs of balance and the auditory nerve. The inner ear receives vibrations from middle ear and changes them to nerve

impulse. These impulse reach the brain through auditory nerves and the brain interprets the impulses and we can hear the sound.



Characteristics of Vibrations

- As we learn before that the to and fro motion of an object is known as vibrations. In an object producing sound, the vibrations are so rapid that we can not observe them properly. We can also produce slower vibrations, also called oscillations, by hanging a ball (bob) from the thread called a simple pendulum.
- A O B Amplitude Mean position
- When the bob is given a small push, it performs a to-and-fro motion for some time and ultimately stops, the position where the bob stops is called the mean position (*O*) or the equilibrium position.
- **Time period :** When the bob moves from one position and returns to the same position, such that it repeats the motion, it is said to complete one oscillation. The time taken by a vibrating object to complete one oscillation is known as time period. It is denoted by *T*.



• **Frequency :** The number of oscillations completed by the vibrating object in one second is known as frequency. It is denoted by *f*

$$f = \frac{\textcircled{0}}{T}$$

Frequency is measured in hertz (Hz).

2 Find the frequency of a wave whose time period is 0.002 second.

Ans.: Here time period of the wave, T = 0.002 s



• **Amplitude :** The maximum displacement of the vibrating object from the central position is known as amplitude of the oscillation. In the case of simple pendulum as shown in the figure, the amplitude is *AO* (or *OB*).

Loudness

In our daily life, we hear two type of sound, soft and loud. Softness or loudness of sound depends upon its volume. Volume is the loudness or softness of sound. Soft sounds have lesser volume than loud sounds. Volume or loudness of sound is directly proportional to the square of amplitude of vibration of the sound.



For example, if the amplitude of a sound becomes two times then loudness of this sound becomes four times.

To study the loudness of sound.

Take a 30 cm metal ruler. Hold the ruler so that it extends about

15 cm over the edge of table.

Flick the free end. Observe the vibrations and listen to the sound. Flick it again, this time make it vibrate with large amplitude. Was the sound produced both times the same ?

What changes did you notice ?

What does loudness depend upon ?

Loudness or the volume of a sound depends on the amplitude of vibrations.

Large amplitudes produce loud sounds while small amplitudes produce soft sound.

This means that loud sounds have vibrations of large amplitude and soft sounds have vibrations of small amplitude. The loudness of sound is measured in decibels (dB). The loudness of different sounds coming from the different sources are given below in the table :

	Source of Sound	Loudness of Sound (dB)
1.	Silence	0
2.	Normal breathing	10
3.	Whishper	20
4.	Normal talk	30-50
5	Normal speech	60-80
6.	Factory	80-90
7.	City traffic	90-100
8.	Aircraft taking off	110-120
9.	Rocket engine	160-180

Pitch

The pitch of a sound depends on its frequency. The sound which have higher frequency of vibrations, have higher pitch and which have lower frequency have lower pitch. Sound of lower pitch is called flat sound whereas which have higher pitch is called shrill sound. It means that shrillness or flatness of a sound is known as pitch.

A woman's voice generally has a higher pitch than a man's voice. Therefore a woman's voice is shrill whereas a man's voice is flat.



To study the pitch of sound.

Take 8 glasses of the same size. Fill them with water to different levels. Strike them one by one with a pencil. Do they emit sound of different frequencies?

Take the help of your music teacher to adjust the level of water in the glasses so that you can get the notes sa, re, ga, ma, pa, dha, ni, sa. Your jal tarang is ready to play.

Notice how the notes sound. Each note is at a higher pitch than the one before it. Re is at a higher pitch than Sa, Ga is at a higher pitch than Re and so on.

Audible and Inaudible Sounds

- Human ear can hear only sounds whose frequencies lies between 20 Hz to 20, 000 Hz. The sound that fall within this range of frequencies is known as audible. Whereas sound which fall out of this range is known as inaudible sound.
- Sound frequencies less than 20 Hz are called infrasonic sound and frequencies more than 20000 Hz are called ultrasonic sound. Human ears cannot perceive either infrasonic or ultrasonic sound. Hence it is called 'inaudible' sound.
- Some animals have a wide range of hearing. For example, dogs can hear the sounds within frequency range of 50 Hz to 45000 Hz and a bat can detect frequencies as high as 100000 Hz.



Ultrasound foetus

• In ultrasound machines, the ultrasonic sound is used to investigate the structure inside the human body for detecting medical problems. Ultrasound is also used to check that a baby is developing normally inside its mother's womb.



Children under the age of five years can hear ultrasonic sounds of frequency up to 25 kHz.

Noise and Music

Many different types of sound we hear around us, but only some of them are pleasant to our ears. The sound, which is pleasant to our ears is called music, musical sound is produced by regular vibrations. The sound produced by irregular vibrations, is not pleasing to the ears and it is called noise. Such as horns of buses, trucks, screech of nails etc. are termed as noise. The noise above 80 dB becomes painful. The range of loudness in decibels and how it is perceived by human is given in the table :

Range of Loudness (dB)	Feeling
0-10	Just audible
10-30	Very quiet
30-50	Quiet
50-70	Loud
70-90	Very loud
90-120	Uncomfortable
120-180	Painful

Noise Pollution

As we have already seen that irregular vibration produce noise. Too much noise in our surroundings is harmful to us and is called noise pollution. The main causes of noise pollution are sound of vehicles,



machines, crackers, explosions loudspeakers including television and transistor radio at high volumes, aeroplanes etc.

- **Harmful effect of noise pollution :** Excess of noise pollution can affect human life in many ways. It can cause many diseases :
 - (i) Lack of sleep (ii) Irritability
 - (iii) Loss of concentration (iv) Hypertension (high blood pressure)
 - (v) Headache (vi) Temporary or even permanent impairment of hearing.
- **Measures to control noise pollution :** Some methods to control noise pollution are given below :
 - (i) Noisy operations and industries must be set up away from any residential areas.
 - (ii) More trees should be planted along the roads and around building to act as noise buffers.
 - (iii) Airport should be made away from residential area.
 - (iv) Good quality silencers should be used in the engine of vehicles and aircraft.
 - (v) TV, music system, loudspeakers should be run at low volumes.
 - (vi) Increasing public awareness about harmful effect of noise pollution by providing them factual information.
 - (vii) Use of horns in the vehicles should be minimized.

Musical Instrument

Musical instruments are used to produce various types of music. In musical instrument different types of vibration are used to produce different types of music. On the basis of vibration produced, musical instrument can be divided in to three main kinds :

(i) **Stringed Instruments :** In stringed instruments, vibrating strings are used to produce music. The frequency of sound is varied by varying the length of the vibrating wire. The pitch of the sound can be changed by changing thickness, tightness or length of the wires. For example : guitar, sitar, violin, veena etc.



(ii) **Wind or Reed Instruments :** The vibrating air column is used to produce music in the case of wind instruments. The pitch of the sound can be changed by changing the length of air column . Flute, shehnai, mouth organ bugle etc. are the example of wind instruments.



(iii) **Percussion Instruments :** The vibrations of a stretched skin (membrane) produce musical sound in the case of percussion instruments. The loudness and pitch of the sound can be changed by striking the skin harder or by stretching the skin tighter. For example: Dholak, tabla, mridangam, drums etc.



The same pitch and loudness on different musical instruments sounds different. If the same note is played on a violin and a flute, it will sound different. This is due to another characteristic of sound known as its quality.

The quality of the sound depends on the part of the musical instrument that is vibrating.

Therefore, sound has three properties.

- (a) Loudness that depends on the amplitude of the vibrations
- (b) Pitch that depends on the frequency of vibrations
- (c) Quality that depends on what part of an instrument is vibrating to produce the sound.

Reflection and Absorption of Sound

- When a sound is incident on a boundary separating two media, a part of it is reflected back into the same medium while the remaining is partly absorbed. These properties of sound have many applications in our daily activities.
- The echo : Sound gets reflected is called an echo.
- It has been found that the sensation of sound persists in our ears for 0.1 second or one-tenth of a second, after the original sound dies off. This time is called persistence of hearing. Thus, if any reflected sound reaches back to our ears, in less than one-tenth of a second, the original sound overlaps with the reflected sound reaching our ears. In other words, no echo is heard.
- An empty house with no curtains or carpets produces echoes as we talk. Designers of theatres, auditoriam and concert halls take steps to reduce this effect. Echoes can be avoided completely by using thick carpets, heavy curtains and soundproof materials like special tiles on the walls and ceiling. These absorb sound. The science of sound that is related to the designing of buildings is called acoustics.
- **Sound absorption :** Sound like light, when falls on a surface, it is partly reflected and partly absorbed. Soft surfaces are better absorbers of sound whereas hard surfaces are better reflectors of sound.



Ships use echoes to measure the depth of the sea and locate underwater objects.

CONCEPT MAP



ESSENTIAL POINTS for COMPETITIVE EXAMS

- **Sound :** Sound is produced by to and fro motion of an object, called vibration.
- **Larynx** : The sound in human is produced in the voice box or larynx.
- **Amplitude :** The maximum displacement of the vibrating body from the central position is known as amplitude of vibration.
- **Time period :** The time taken by a vibrating object to complete one oscillation is known as time period.
- **Frequency :** The number of oscillations completed in one second is known as frequency.
- Loudness : The loudness of sound depends upon amplitude of vibrations and measured in decibels (dB).
- **Pitch :** Pitch of sound depends upon frequency of vibration.
- **Audible and Inaudible Sound :** Humans can hear sounds within the frequency range 20 to 20000 Hz. The sound falling within this frequency range is known as audible sound otherwise inaudible.
- Ultrasonic : Sound having frequency above 20000 Hz is called ultrasonic sound.
- **Infrasonic :** Sound having frequency below 20 Hz is called infrasonic sound.
- **Noise :** Unpleasant sound is called noise.
- Sound needs a medium to travel and the speed of sound is different in different medium.
- **Echo** : It is the repetition of the original sound heard after it is reflected from a distant, dense and rigid object.

SOLVED EXAMPLES

 Fill in the blanks with appropriate words: If a violin string is pulled strongly, its amplitude of vibration _____ (increase/ decrease) and the note heard is _____ (louder/ softer). If it is pulled lightly, its amplitude of vibration. _____ (increase/decrease) and the note heard is _____ (louder/softer).
 Ans.: increase, louder, decrease, softer

2. An object vibrates with a frequency of 15 Hz. Which of the following is true?

- (a) It produces sound which we can hear.
- (b) It does not produce sound.
- (c) It produces sound which we cannot hear.
- (d) It produces sound which we can hear if we strain our ears.

Ans.: (c) Human ear cannot hear the sound below 20 Hz frequency.

- 3. Which of these is expected to be the best absorber of sound?
 - (a) Iron (b) Wood
 - (c) Wool (d) Cemented wall
- **Ans.:** (c) porous material like wool is an effective sound absorber.

4. What you mean by loudness and pitch of sound?

Ans.: Loudness of the sound produced by a vibrating object depends on the amplitude of vibration. Loudness is proportional to the square of the amplitude. The shrillness of sound is called its pitch. It depends on the frequency of vibration. The higher the frequency the more shrill is the sound.

5. Give some measures to control noise pollution?

Ans.: Some methods of controlling noise pollution are as follows:

(i) Reducing noise emission by developing low-noise products, for example, better silencers for automobiles.

- (ii) Control over recreational noise, such as use of loudspeakers.
- (iii) Measures at home such as double glazed glass in windows to keep out noise.

6. Find the time period of a wave whose frequency is 400 Hz?

Ans.: Here, frequency of the wave, f = 400 Hz

Time period of the wave, $T = \frac{1}{2} = \frac{1}{400} = 0.0025 \text{ s}$

7. Differentiate between musical sound and noise?

Ans.: Musical Sound

- (i) It has a pleasant (i) effect on the ear.
- (i) It has an unpleasant effect on the ear.

Noise

- (ii) It consists of a series of sound impulses which follow one another regularly.
- (ii) The sound impulses do not follow one another regularly.
- (iii) The frequency(iii) The frequency ofof musicalnoise is low.sound is high.
- 8. Suppose you and your friend are on the Moon. Will you be able to hear any sound produced by your friend?
- **Ans.:** Sound waves need a material medium for their propagation. Since there is no atmosphere on the Moon, one person cannot hear the sound produced by another person.
- 9. The frequency of a source of sound is 200 Hz. How many times does it vibrate in a minute?
- **Ans.:** Since the frequency of the source of sound is 200 Hz,

number of vibrations of the source in 1 second = 200

Number of vibrations of the source in 1 minute (*i.e.*, 60 second) = $200 \times 60 = 12000$ Hz

10. How is ultrasound used for cleaning?

- **Ans.:** The object to be cleaned is placed in a cleaning solution. When ultrasonic waves are passed through the solution, due to their high frequency, particles of dust, dirt and grease get detached even from the unreachable portion of the object and drop out in the solution.
- 11. How can you make a building sound proof?
- **Ans.:** A building can be made sound proof by insulating it from its surroundings. The doors used in such buildings should be heavy and sound proof. All the surfaces including the floor, are also covered with several centimetres of highly absorbent materials such as rock wood or asbestos fibre. Further, absorbent deflectors can be placed at suitable places in the building.
- 12. The sound of distant horses can be heard by applying the ear to the ground whereas it is inaudible if the ear is held a little distance above the ground. Explain?
- **Ans.:** We know that loudness is directly proportional to the density of the medium. The density of

ground is much higher than that of air. Thus, the sound of distance horses, when conveyed through ground, is louder than when through air. Therefore, by applying ear to the ground, we can hear this sound. But when the ear is a little distance above the ground, the sound travels through air and is hardly audible.

13. The sonic boom of an aircraft has a time period of 0.00005 s. Calculate the frequency of the sound produced.

Ans.: Here, *T* = 0.00005 s,

$$f = \frac{1}{T} = \frac{1}{0.00005} = 20000 \text{ Hz}$$

- **14.** What are the three factors on which the speed of sound depend upon?
- **Ans.:** The speed of sound depend upon the properties like elasticity and density of medium through which it propagates and the temperature of the medium.

15. Define persistence of hearing.

Ans.: The sensation of sound persists in our ears for 0.1 second or one-tenth of a second, after the original sound dies off. This time is called persistence of hearing.

NCERT SECTION

1. Choose the correct answer.

- Sound can travel through
- (a) gases only (b) solids only
- (c) liquids only
- (d) solids, liquids and gases.

Ans.: (d) Solids, liquids and gases

- 2. Voice of which of the following is likely to have minimum frequency?
 - (a) Baby girl (b) Baby boy
 - (c) A man (d) A woman

Ans.: (a) Baby girl

- 3. In the following statements, tick 'T' against those which are true, and 'F' against those which are false.
 - (a) Sound cannot travel in vacuum.
 - (b) The number of oscillations per second of a vibrating object is called its time period.
 - (c) If the amplitude of vibration is large, sound is feeble.
 - (d) For human ears, the audible range is 20 Hz to 20, 000 Hz.
 - (e) Lower the frequency of vibration, higher is the pitch.
 - (f) Unwanted or unpleasant sound is termed as music.
 - (g) Noise pollution may cause partial hearing impairment.

(b) False

Ans.: (a) True

True

- (e) False (f) False
- (g) True
- 4. Fill in the blanks with suitable words.
 - (a) Time taken by an object to complete one oscillation is called _____.
 - (b) Loudness is determined by the _____ of vibration.
 - (c) The unit of frequency is _____.
 - (d) Unwanted sound is called _____.

(e) Shrillness of a sound is determined by the _____ of vibration.

- Ans.: (a) time period(b) amplitude(c) hertz(d) noise(e) frequency
- 5. A pendulum oscillates 40 times in 4 seconds. Find its time period and frequency.

Ans.: Number of oscillations = 40

Time taken to complete 40 oscillations = 4 s

Time taken to complete one oscillation = $\frac{4}{10}$

= 0.1 s

So time period = 0.1 s

Frequency
$$=\frac{1}{\text{Time period}} = \frac{1}{0.1} = 10 \text{ Hz}$$

6. The sound from the mosquito is produced when it vibrates its wings at an average rate of 500 vibrations per second. What is the time period of the vibration ?

Ans.: Total vibrations = 500

Time taken to complete 500 vibration = 1 s Time taken to complete 1 vibration

$$=\frac{1}{500}=0.002$$
 s

Time period of vibration = 0.002 s So time period = 0.002 s

- 7. Identify the part which vibrates to produce sound in the following instruments.
 - (a) Dholak (b) Sitar

(c) Flute

Ans.: (a) Stretched membrane

(b) Strings (c) Air column

- 8. What is the difference between noise and music? Can music become noise sometimes?
- **Ans.:** The sound which is unpleasant for our ears is called noise. Music is the sound which is pleasant for our ears and has soothing effect. Music becomes noise sometimes when it crosses the bearable range of sound for our ears.

- 9. List sources of noise pollution in your surroundings.
- **Ans.:** There are various sources which cause sound pollution in our surroundings, for example, loud sound of T.V., radio, loud sound of machines in factories, loud musics in parties and honking of horns etc.
- **10.** Explain in what way noise pollution is harmful to humans.
- **Ans.:**There are many harmful effects of noise pollution. They are as follows.
 - (i) Noise pollution can cause temporary or permanent deafening.
 - (ii) Noise pollution can cause many health related problems like headache, high blood pressure etc.
 - (iii) It can cause mental illness due to lack of sleep.
- **11.** Your parents are going to buy a house. They have been offered one on the roadside and another three lanes away from the roadside. Which house would you suggest your parents should buy? Explain your answer.
- **Ans.:** I would suggest my parents to buy house three lanes away from the roadside because area away from the roadside have less traffic and thus less noise pollution. This would safe guard our health and peace of mind.
- **12**. Sketch larynx and explain its function in your own words.

Ans.: Larynx is the top part of the trachea. It is also called the voice box. The larynx contains the vocal cords. These are V shaped ridges of muscle tissue on the inside lining of the larynx. They vibrate when air passes between them too produce speech.

When you breathe in, air passes in to the larynx and down the trachea towards the lungs. When you swallow, the larynx moves upwards slightly and a flap of cartilage tissue at the back of the tongue called epiglottis closes over the entrance to the larynx. This ensures that food or drink go down the oesophagus (gullet) and not down the trachea.



- 13. Lightning and thunder take place in the sky at the same time and at the same distance from us. Lightning is seen earlier and thunder is heard latter. Can you explain why?
- **Ans.:** Lightning and thundering take place in the sky at same time and at the same distance from us but lightning is seen earlier than thunder is heard because the speed of light is much greater than that of sound so it reaches us before the sound does.

EXERCISE

Multiple Choice Questions

Level - 1

- 1. The sound in human is produced by
 - (a) heart (b) mouth
 - (c) larynx (d) hair
- 2. Frequency of sound is lowest for
 - (a) man (b) woman
 - (c) young boy (d) young girl
- 3. In which medium sound travel fastest
 - (a) solid (b) liquid
 - (c) gas (d) vacuum
- 4. Unit of frequency is
 - (a) decibel (dB) (b) hertz (Hz)
 - (c) meter (d) second
- 5. Inverse of frequency is called
 - (a) amplitude (b) frequency
 - (c) loudness (d) time period
- 6. The hearing range of human ear is
 - (a) 20 Hz to 20, 000 Hz
 - (b) less than 20 Hz
 - (c) more than 20,000 Hz
 - (d) 20,00 Hz to 25,000 Hz
- 7. The length of the vocal cords is maximum for
 - (a) man (b) woman
 - (c) boy (d) girl
- 8. Shrill sound is of
 - (a) higher frequency (b) lower frequency
 - (c) higher amplitude (d) lower amplitude
- **9.** Frequency of sound produced by a body is 10 Hz, then range is
 - (a) ultrasonic (b) infrasonic
 - (d) none of these
- 10. Unit of loudness(a) hertz (Hz)

(c) audible

- (b) meter
- (c) second (d) decibel (dB)

11. Which of these pictures correctly show the way sound vibrations travel ?



- **12.** The speed of sound in air is
 - (a) 330 km s⁻¹ (b) 330 km h⁻¹
 - (c) 330 m s^{-1} (d) 300 m s^{-1}
- **13.** Regular vibration produces
 - (a) noise (b) music
 - (c) both (a) and (b) (d) none of these
- **14.** A person, pressing his ear on the railway tracks can hear an approaching train. This is possible because of
 - (a) vibration of railway tracks
 - (b) vibration of air
 - (c) speed of sound is more in solid medium
 - (d) hearing ability of the man
- **15.** A person can be identified by the quality of sound produced by him. The characteristic of a sound can be determined by
 - (a) amplitude (b) frequency
 - (c) loudness (d) all of these
- **16.** The voices of men, women and children are different due to difference in length of
 - (a) larynx (b) lungs
 - (c) vocal cords (d) wind pipe
- **17.** An object moving at a speed greater than that of sound is said to be moving at
 - (a) ultrasonic speed (b) sonic speed
 - (c) infrasonic speed (d) supersonic speed
- **18.** The velocity of sound in vacuum is
 - (a) 332 m s^{-1} (b) 330 m s^{-1}
 - (c) 288 m s^{-1} (d) 0

- **19.** An object oscillates 50 times in one second. What should be its frequency ?
 - (a) 0.2 Hz (b) 0.02 Hz
 - (c) 0.002 Hz (d) 50 Hz
- **20.** The time period of a simple pendulum is 0.2 s. What is its frequency of oscillation?
 - (a) 0.5 Hz (b) 5 Hz
 - (c) 50 Hz (d) 1 Hz
- **21.** Hertz stands for
 - (a) second (b) $second^{-1}$
 - (c) meter (d) meter⁻¹
- **22.** An aeroplane travelling at the speed of sound will have a velocity of
 - (a) 100 km h^{-1} (b) 1180 km h^{-1}
 - (c) 1540 km h^{-1} (d) 1620 km h^{-1}
- 23. Sound is produced in a bamboo flute because
 - (a) air starts vibrating
 - (b) bamboo starts vibrating
 - (c) air hits the bamboo
 - (d) direction of air is changed
- 24. The difference between a musical sound and noise is
 - (a) amplitude (b) loudness
 - (c) vibration (d) all of these
- **25.** Noise pollution can cause
 - (a) insomnia
 - (b) hypertension
 - (c) hearing impairment
 - (d) all of these
- **26.** If you go on increasing the stretching force on a wire in a guitar, its frequency
 - (a) increases
 - (b) decreases
 - (c) remains unchanged
 - (d) none of the above
- 27. A vibrating body
 - (a) will always produce sound
 - (b) may or may not produce sound if the amplitude of vibration is low
 - (c) will produce sound which depends upon frequency
 - (d) none of these

- **28.** The instrument used in the laboratory to produce sound of a fixed frequency is
 - (a) simple pendulum (b) tuning fork
 - (c) thermometer (d) meter scale
- Higher the frequency of a musical sound, ________
 is its pitch.
 - (a) lower (b) higher
 - (c) remains same (d) none of these
- **30.** Quality of sound is used to distinguish between
 - (a) Noise and music
 - (b) Two different vibrating bodies
 - (c) Two notes produced by same vibrating body
 - (d) All of the above

Level - 2

- **31.** For an oscillating pendulum of fixed length, which of the following is true ?
 - (a) Frequency depends on amplitude of oscillation
 - (b) Frequency and time period are not related.
 - (c) Time period depends on amplitude of oscillation.
 - (d) Frequency and time period are related and do not depend on amplitude of oscillation.
- **32.** Which one of the following material will reflect sound better?
 - (a) Thermocole
 - (b) Curtain made from cloth
 - (c) Steel
 - (d) Paper
- 33. An object vibrated with a frequency of 15 Hz.Which of the following is true ?
 - (a) It produces sound which we can hear.
 - (b) It does not produce sound.
 - (c) It produces sound which we cannot hear.
 - (d) It produces sound which we can hear if we strain our ears.
- 34. Time taken for 10 oscillation of a body is20 second, then time period of the body is
 - (a) 1 second (b) 2 second
 - (c) 3 second (d) 4 second

- **35.** Large amplitude of sound vibrations will produce
 - (a) loud sound (b) weak sound
 - (c) slow sound (d) none of these
- **36.** The pitch of sound depends on
 - (a) frequency (b) amplitude
 - (c) both of these (d) none of these
- **37.** A scientist performed an experiment as shown in the picture below.



What do you think happened as air was pumped out of the jar and he rang the bell?

- (a) The sound became louder
- (b) The sound became fainter first and louder once all the air was pumped out.
- (c) The sound could not be heard anymore
- (d) The sound was the same as before.
- 38. Which of them has highest amplitude ?



39. Which of them has highest frequency?



- **40.** The speed of sound in solid, liquid and gas can be correctly compared as
 - (a) solid > liquid > gas
 - (b) liquid > gas > solid
 - (c) liquid > solid > gas
 - (d) gas > liquid > gas

- **41.** Flash and thunder are produced simultaneously. But thunder is heard a few seconds after the flash is seen. This is because
 - (a) speed of sound is greater than speed of light
 - (b) speed of sound is equal to the speed of light
 - (c) speed of light is much greater than the speed of sound
 - (d) none of these.
- 42. Which of the following is NOT correct ?
 - (a) More oscillation per second, higher time period
 - (b) Greater amplitude greater loudness
 - (c) Higher pitch, higher frequency of vibration
 - (d) More the value of decibel, higher is the noise
- **43.** The buzzing sound produced by a mosquito is produced by
 - (a) its mouth
 - (b) vibration of surrounding air
 - (c) vibration of wings
 - (d) none of these
- 44. The membrane of a drum vibrates to produce sound. Similarly the strings of a sitar vibrates to produce sound. Based on these two examples answer the following question. Which part of a whistle vibrates to produce sound ?
 - (a) body of whistle
 - (b) air
 - (c) mouth of the person
 - (d) all of the above
- **45.** When a tuning fork was struck and brought near a bucket of water, a wave as shown in figure was formed on its surface. If the fork is struck much harder and brought near the surface, what will increase ?
 - (a) Frequency
 - (b) Wavelength
 - (c) Velocity
 - (d) Amplitude
- **46.** By changing length of the scale protruding out of table and vibrating it we can produce sounds of different frequencies. This is possible due to

- (a) change in frequency
- (b) change in velocity
- (c) change in amplitude
- (d) all of the above
- **47.** A bomb explodes on the moon. How long will it take the sound to reach the earth ?
 - (a) 10 seconds (b) 1000 seconds
 - (c) 1 day (d) none of these
- **48.** The frequency of a source is 20 kHz. The frequencies of sound wave produced by it in water and air will be
 - (a) same as that of source 20 kHz
 - (b) > 20 kHz
 - (c) < 20 kHz
 - (d) depends upon velocity
- **49.** Which of the following statement is true?
 - (a) Sound and light both require medium for propagation
 - (b) Sound travel through vacuum, but light can not
 - (c) Sound needs medium, but light doesn't needs medium for its propagation
 - (d) Sound and light both can not travel in a medium.
- **50.** Loudness of sound is directly proportional to the
 - (a) amplitude of the wave
 - (b) distance from the source and sound
 - (c) frequency of the wave
 - (d) wavelength of the wave

Fill in the Blanks

- 1. The to and fro motion of an object is called
- 2. The larynx has vocal cords.
- 3. Women have vocal cords than men.
- 4. Sound can not travel through
- 5. The maximum displacement of the vibrating body from the central position is known as of oscillation.
- 6. The frequencies below 20 Hz are known as sound.

- 7. Pitch of sound depends upon of a vibrating body.
- 8. The number of vibration per second are called
- 9. Time taken to complete one oscillation is called
- **10.** Sound required a to travel.

True or False

- **1.** The pitch of a sound depend on frequency.
- **2.** The loudness of sound depends on amplitude of vibration.
- 3. The frequency is measured in decibels.
- **4.** Irregular vibrations produces music.
- **5.** Trees act as a noise buffers.
- 6. Human can hear the sound through vocal cords.
- 7. Human can hear sound within the frequency range 20 to 20, 000 Hz.
- 8. Loudness of sound measured in Hertz (Hz).
- 9. Sound can not travel through vacuum.
- **10.** Unwanted sound in the air is called noise pollution.

Match the Following

In this section, each question has two matching lists. Choices for the correct combination of elements from List-I and List-II are given as options (a), (b), (c) and (d) out of which one is correct.

- 1. List-I (P) String vibration 1
 - List-II on 1. Tabla
 - (Q) Membrane 2. Bicycle bell vibration
 - (R) Vibration of air 3. Gitar
 - (S) Vibration of plate 4. Flute

Code :

Р	Q	R	S
(a) 3	1	4	2
(b) 4	3	2	1
(c) 1	4	2	3
(d) 2	3	1	4

2.		List-I				List-II
	(P)	Audib	le range		1.	Above 2000 Hz
	(Q)	Infraso	Infrasonic range 2.			50 Hz to 45000 Hz
	(R)	Ultrasonic range 3.		3.	Below 20 Hz	
	(S)	Dog's	hearing		4.	20 Hz to 20 kH
		range				
	Co	de :				
		Р	Q	R		S
	(a)	2	1	3		4
	(b)	4	3	1		2
	(c)	1	3	2		4
	(d)	3	2	4		1
3.		List-I				List-II
	(P)	Flatter	voice		1.	Frequency
	(Q)	Shrille	r voice		2.	Amplitude
	(R)	Pitch			3.	Man
	(S)	Loudn	iess		4.	Woman
	Co	de :				
		Р	Q	R		S
	(a)	1	3	2		4
	(b)	4	3	1		2
	(c)	2	4	3		1
	(d)	3	4	1		2
Л		I ist-I				I jet-II
т.	(P)	Sound	cannot		1	Decibel
	(1)	propa	vate thro	nıoł	יד. ז	Deciber
	(\mathbf{O})	Unit o	f freque	ncv	י י	Noise huffers
	(\mathbf{Q})	Unit o	f loudne	ney Nee	2. 3	Vacuum
	(S)	Trees	act as	.00	5. 4	Hortz
	(0)	do ·	act as		ч.	
	CU	uс. Р	0	R		S
	(a)	2	x 3	4		1
	(b)	4	3	2		1
	(c)	3	4	1		2
	(d)	1	2	4		3
_	()	-				- -
5.	(D)	L1St-I	:1	•	1	L1St-II
	(P)	Regula	ar vibrat	10n	1.	Solid
		produ	ces	1.	•	NT .
	(Q)	Speed	of soun	d 15	2.	Noise
		maxim	num in		2	
	(K)	Huma	ns canno	ot	3.	Music
		near	1	L.	. 4	·
	(5)	Irregu	iar vibra	t10r	14.	infrasonic sound
		produ	ces			

	Р	Q	R	S
(a)	3	1	4	2
(b)	1	4	3	2
(c)	4	3	1	2
(d)	2	4	3	1

Assertion & Reason Type

Directions: In the following questions, a statement of assertion is followed by a statement of reason. Mark the correct choice as:

(a)	If both assertion and reason are true and reason
	is the correct explanation of assertion
(b)	If both assertion and reason are true but reason
	is not the correct explanation of assertion
(c)	If assertion is true but reason is false
(d)	If assertion is false but reason is true.

- 1. Assertion : Two person on the surface of the moon cannot talk to each other.
 - **Reason** : There is no atmosphere on moon.
- 2. Assertion : On a rainy day sound travel slower than on a dry day.
 - **Reason** : When moisture is present in air the density of air decreases.
- **3. Assertion :** The sound produced by a flute is more shrill than the sound produced by a tabla.
 - **Reason** : Frequency produced by flute will be greater than the frequency produced by tabla.
- **4. Assertion :** Sound waves do not travel through vacuum.
 - **Reason** : The speed of sound is too small when compared to speed of light.
- 5. Assertion : Every vibrating body is a source of sound.
 - **Reason** : All sounds are audible to us.
- 6. Assertion : The sound which cannot be heard pleasantly is called noise.
 - **Reason** : The sound above 80 dB becomes painful.

	Reason	: Human ear can only hear sound of frequency range 20 Hz to
8.	Assertion	We cannot hear the sound producedby a vibrating pondulum
	Reason	: The frequency of the pendulum is very less.
9.	Assertion	: Trees should be planted along the roads to control noise pollution.
	Reason	: Trees act as noise buffers.
10.	Assertion	: Women have shriller sound than men.
	Reason	: Men produced higher frequency

Assertion : Humans cannot hear the sound of

7.

Reason : Men produced higher frequency sound than women..

Comprehension Type

PASSAGE-I : Human ears can pick up sounds ranging in amplitude (loudness) from 10 dB to 180 dB. A sound is considered to be normal if it is between 50 dB to 60 dB. Sounds above 80 dB are painful and cause various health problems.

- 1. Which of the following sounds human can hear, comfortably?
 - (a) 95 dB (b) 60 dB
 - (c) 100 dB (d) 180 dB
- 2. The range of the normal sound is
 - (a) 0 10 dB (b) 40 50 dB(c) 50 - 60 dB (d) 80 - 90 dB
- 3. The sound becomes painful, if loudness
 - The sound becomes painful, if loudness is (a) above 50 dB (b) below 50 dB
 - (c) above 80 dB (d) below 80 dB
- **PASSAGE-II**: The number of oscillations or vibrations

made by a vibrating body in one second is known as the frequency of the wave. The S.I. unit of frequency is hertz (Hz) which is named after the name of scientist Heinrich Hertz.

Time taken to complete one vibration by the vibrating body is known as time period. Time period and frequency are related as Time period = $\frac{1}{\text{frequency}}$

1. The frequency of a source of sound is 20 Hz find its time period.

(a)	$0.05 \mathrm{s}$	(b)	0.5 s
(c)	0.2 s	(d)	$0.02~\mathrm{s}$

- 2. A vibrating body vibrates 200 times in 5 second, calculate its frequency ?
 - (a) 30 Hz (b) 40 Hz
 - (c) 500 Hz (d) 1000 Hz
- 3. A boy heard a sound of frequency 100 Hz at a distance of 500 m from the source of sound. What is the time period of oscillating particles of the medium?
 - (a) 0.1 s (b) 0.01 s (c) 0.2 s (d) 0.02 s

PASSAGE-III : The human voice can produce sounds with a frequency between 60 Hz and 1300 Hz. It is interesting to note that a normal human ear can hear sound of frequency between 20 Hz to 20,000 Hz. The sound of frequency greater than 20000 Hz is called ultrasonic and the sound of frequency below 20 Hz is known as infrasonic.

- 1. A human can produce sound of frequency
 - (a) 20 Hz (b) 200 Hz (c) 15 kHz (d) 20 kHz
- 2. Frequency of ultrasonic sound is
 - (a) below 20 Hz (b) above 20 Hz
 - (c) below 20000 Hz (d) above 20000 Hz
- 3. Frequency of infrasonic sound is
 - (a) below 20 Hz (b) above 20 Hz
 - (c) below 20000 Hz (d) above 2000 Hz

Subjective Problems

Very Short Answer Type

- **1.** What is sound?
- 2. What is vibration?
- 3. Name the sound producing organ in humans.
- **4.** Do the frequency of sound produced by men and women are same?

- 5. What types of medium is required for sound to travel?
- 6. Write the name of the organ through which human receives the sound.
- 7. What is the unit of frequency?
- 8. What is the name of the sound produced by irregular vibrations?
- 9. On which factor pitch of the sound depends?
- **10.** What is the range of frequency that a human can hear?
- **11.** What is the ultrasonic sound?
- **12.** What is the unit of loudness?
- **13.** What are sounds of frequencies below 20 Hz called?
- **14.** In which medium the speed of the sound is maximum?
- **15.** Can sound travel through vacuum?

Short Answer Type

- What do you understand by "audible" and "inaudible" range of sound?
- 2. Why do women have shriller voice than men?
- **3.** How is sound produced?
- **4.** Explain the importance of sound in our daily life.
- 5. Explain with the help of an activity that vibrating bodies produce sound.
- 6. Name the organ in human that produces sound. How does it work?
- A pendulum oscillates with the frequency of 50 Hz. Find its time period?
- 8. How does loudness of the sound depends upon amplitude?

- 9. What do you understand by shriller sound?
- **10.** What is the difference between noise and music?

Long Answer Type

- With the help of an activity show that sound

 (i) can travel through solids
 - (ii) cannot travel through vacuum.
- 2. What are the major sources of noise pollution ? What are the harmful effect of noise pollution?
- **3.** Write the methods to control noise pollution.
- **4.** Write the applications of the ultrasound.
- 5. How does loudness of sound is affected by amplitude?

Integer Answer Type

In this section, each question, when worked out will result in one integer from 0 to 9 (both inclusive)

- A person lives at a distance of 1.32 km from a factory. If the speed of sound in air be 330 m s⁻¹, how much time will the sound of factory siren takes to reach the worker?
- A boy stands 165 m in front of a high wall and then blows a whistle. Calculate the time interval when he hears an echo (speed of sound = 330 m s⁻¹)
- 3. The speed of sound is 330 m s⁻¹ and that of light is 3×10^8 m s⁻¹. The ratio of speed of sound to that of light is $11 : 10^x$. Find the value of *x*.
- 4. The distance of a reflecting surface from a source is 513 m, and speed of sound is 342 m s^{-1} . Find the time in which the echo return.
- A sound wave has a frequency 1000 Hz and speed 320 m s⁻¹. How long will it take to move through 1 km.



Sound

Multiple Choice Questions

- 1. (c): In humans, the sound is produced by the voice box or larynx.
- 2. (a)
- 3. (a): Speed of sound is more in solids, less in liquids and least in gases.
- **4. (b)**: Unit of frequency is Hertz (Hz).
- **5.** (d): Inverse of frequency is called time period.
- 6. (a): The hearing range of human ear is 20 Hz to 20,000 Hz.
- 7. (a): Women have shorter vocal cords (about 15 mm long) than men (about 20 mm long) children have very short vocal cords.
- 8. (a): If the frequency is higher then sound is shrill.
- **9.** (**b**): If the frequency of sound is below 20 hertz, it is called infrasonic.
- **10.** (d): Loudness is measured in decibels (dB).
- **11.** (c): Sound travel in all direction.
- 12. (c)
- **13.** (b): Music is produced by regular vibrations and noise is produced by irregular vibrations.
- **14.** (c): Speed of sound is more in solid than air.
- 15. (c)
- **16.** (c): Voice depend on length of vocal cords.
- **17.** (d): An object moving at a speed greater than that of sound speed is said to be moving in supersonic speed.

18. (d): Sound require a medium to travel.

19. (d): Frequency =
$$\frac{\text{no. of oscillations}}{\text{time taken}} = \frac{50}{1}$$

= 50 Hz

20. (b): Time period of simple pendulum = 0.2 s Frequency = $\frac{1}{\text{time period}}$

Frequency =
$$\frac{1}{0.2}$$
 = 5 Hz

- **21.** (b): Hertz and second⁻¹, both are the unit for frequency.
- **22.** (b): Speed of sound = 330 m s⁻¹

$$=\frac{330\times18}{5}=1180$$
 km h⁻¹

- 23. (a): Vibration of air column produce sound.
- **24.** (c) : Music and noise are sound that have regular and irregular vibrations respectively.
- **25.** (d): Excessive noise in the surrounding may cause many health related problems like lack of sleep, hypertension, temporary or permanent impairment of hearing.
- **26.** (a): If guitar wire is tightened, then the frequency of vibration also increases.
- 27. (a)
- 28. (b)
- **29.** (b): Sound waves with high frequency produces sounds of high pitch.
- 30. (b)
- **31.** (d): Frequency and time period are related to each other.

$$Frequency = \frac{1}{Time period}$$

32. (c)

- **33.** (c): For human ear, the range of audible frequencies is 20 Hz to 20,000 Hz.
- **34.** (d): Time for 10 oscillations = 20 s

Time for 1 oscillation $=\frac{20}{10}=2$ s

- **35.** (a): Large amplitude of sound vibrations will produce louder sound.
- **36.** (a): The pitch of sound depends on frequency.
- **37.** (c) : Sound requires a medium to travel.
- 38. (c)
- **39.** (d): The number of oscillations produced by the vibrating body in one second is called its frequency. Number of oscillations is maximum in option (d).
- **40.** (a): Speed of sound is more in solid than in liquid and least in gas.
- **41.** (c) : Light travel faster than sound.
- **42.** (a): More oscillation per second, lesser time period.
- 43. (c)
- **44.** (b): In a whistle, the air column vibrate to produce sound.
- **45.** (d): The natural frequency of tuning fork remains the same.
- 46. (a)
- 47. (d): Sound requires a medium to travel.
- **48.** (a): Frequency of sound is a factor of source, so it will remain same in all medium.
- 49. (c): Sound wave is called mechanical wave because it needs material medium to travel. It can not travel in vacuum.
- **50.** (a): The loudness of sound is directly proportional to the amplitude of vibration.

Fill in the Blanks

- **1.** Vibration
- 3. Shorter

5.

7.

- Amplitude 6. Infrasonic
- Frequency 8. Frequency

Two

Vacuum

2.

4.

9. Time period 10. Medium

True or False

1.	True	2.	True
3.	False	4.	False
5.	True	6.	False
7.	True	8.	False
9.	True	10.	True

Match the Following

- **1.** (a): P 3, Q 1, R 4, S 2
- **2.** (b): P 4, Q 3, R 1, S 2
- **3.** (d): P 3, Q 4, R 1, S 2
- **4.** (c): P 3, Q 4, R 1, S 2
- **5.** (a): P 3, Q 1, R 4, S 2

Assertion & Reason Type

- 1. (a): Sound require medium to travel. As there is no atmosphere (vacuum) on the surface of the moon, therefore sound cannot reach from one person to another.
- 2. (d): When moisture is present in air, the density of air decreases. It is because the density of water vapours is less than that of dry air. The velocity of sound is inversely proportional to the square root of density, hence sound travel faster in moist air than in the dry air. Therefore, on a rainy day sound travels faster than on a dry day.
- **3.** (a): The frequency produced by flute is higher than that of tabla and higher the frequency we can say that the sound is more shrill.

- **4.** (**b**): Sound is mechanical wave, which require medium to travel.
- 5. (c) : All sound are not audible to us.
- 6. (b) 7. (a) 8. (a) 9. (a)
- **10.** (c): Women produce higher frequency sound than men.

Comprehension Type

Passage-I

2. (c)	3. (c)	
2. (b)	3. (b)	
2. (d)	3. (a)	
	2. (c) 2. (b) 2. (d)	 2. (c) 3. (c) 2. (b) 3. (b) 2. (d) 3. (a)

Subjective Problems

Very Short Answer Type

- **1.** Sound is a form of energy or the medium by which we can communicate with each other.
- 2. The to and fro motion of an object is called vibration.
- 3. Voice box or larynx
- **4.** No, the frequency of sound of men and women are not same.
- 5. Sound can travel through solids, liquids and gases.
- **6.** Ear
- 7. Hertz
- 8. Noise
- 9. The pitch of the sound depends on frequency.
- **10.** Human can hear the sound of frequencies 20 Hz to 20,000 Hz.
- **11.** Sound having frequency above 20,000 Hz is called ultrasonic sound.
- 12. Decibel (dB)
- **13.** Infrasonic sounds.
- 14. In solids, the speed of sound is maximum.
- **15.** No, sound can not travel through vacuum.

Short Answer Type

- 1. Human ear can hear sound of frequency 20 Hz to 20000 Hz. Out of this frequency range, humans can not hear it. So the sound having the frequency range 20 to 20000 Hz is called audible sound and out of this range is called inaudible sound.
- 2. Women have shorter vocal cords than men so the frequency of sound of women is greater than men. So women have shriller voice than men.
- 3. The vibrating bodies produce the sound. When a body vibrates, sound is produced. If vibrations are stopped the sound is not produced any more.
- 4. Sound play an important role in our daily life. Our life depends on sound for each and every action. Without sound we cannot know what others communicate or want to say. Sound enables us to communicate with each other.
- 5. Take a rubber band, put it around the longer side of a pencil box. Insert two pencils between the box and stretched rubber. Pluck the rubber band somewhere in the middle. You hear a sound and also see that rubber band vibrate. This activity shows that vibrating bodies produce sound.
- 6. In humans, the sound is produced by the voice box or larynx. The voice box has two vocal cords stretched across it, in such a way that it leaves a slit for the passage of air. When the lungs forces air through slit, the vocal cords vibrate to produce sound.

7. Time period =
$$\frac{1}{\text{Frequency}}$$

= $\frac{1}{50}$ = 0.02 second.

- 8. Loudness of sound is directly proportional to the square of amplitude of vibration. It means that the loudness of sound increases with increase in its amplitude.
- **9.** Sound of higher pitch is known as shriller sound. The pitch of the sound depends upon frequency of sound. The sound which have higher frequency of vibrations, have higher pitch.

10. The sound, which is unpleasant to ears is termed as noise. Noise is produced by irregular vibration. The sound which is pleasing to ears is known as music. Music is produced by regular vibrations.

Long Answer Type

 (i) Take a long metal rod and hold its one end to your ear. Ask your friend to gently scratch or tap at the other end of the metal rod. You can hear the sound. The sound reaches to your ear through solid rod. The other friends cannot hear the sound because sound is very less. This activity shows that sound can travel in solids.



Sound travels through a metre scale

(ii) Put an electric bell inside a closed jar connected with a vacuum pump. Connect the electric bell with a battery (as shown in the figure) and close the circuit by switching on the current. We can now clearly hear the ringing sound of the bell. Now start evacuating air from the glass jar using the vacuum pump. We can observe that the loudness of the sound gradually decreases. The sound of the bell becomes more faint. Ultimately, a stage will come when you may not be able to hear the sound at all. This activity illustrates that sound requires a material medium (air in this case) to travel. In the vacuum of outer space, sound cannot travel, since there is no medium such as air. So, is the case on the moon.



Sound cannot travel through vaccum

- 2. The major sources of noise pollution :
 - (i) Noise is produced by traffic.
 - (ii) Loud sound of Radio, T.V. etc.
 - (iii) Loud music in marriage and other religious function.
 - (iv) Sound of crackers.
 - (v) Sound of aeroplanes.
 - (vi) Noise created by construction works.

Noise pollution causes many diseases in human.

(i) Lack of sleep

4.

- (ii) Irritability and headache
- (iii) Loss of concentration
- (iv) Hypertension (high blood pressure)
- (v) Temporary or even permanent impairment of hearing.
- 3. Methods to control noise pollution are :
 - (i) Noisy operation and industries must be set up away from any residential area.
 - (ii) More trees should be planted along the roads and around building.
 - (iii) Airport should be made away from residential area.
 - (iv) Good quality silencer should be used in the engine of vehicles and aircraft.
 - (v) TV, music system, loudspeakers should be run at low volumes.
 - (vi) Increasing public awareness about harmful effect of noise pollution by providing them factual information.
 - (vii)Use of horns in the vehicles should be minimized.
 - (i) Ultra sound is used as diagnostic tool in medical science.
 - (ii) It is used to releave pains in joints and muscles.
 - (iii) It is used to detect holes in metals and structures.
 - (iv) It is used to test the thickness of various parts.
- 5. Loudness of sounds is proportional to the square of amplitude of the vibrations producing the sound. If the amplitude becomes twice, the loudness increases by a factor of four. The unit of loudness is decibal (dB). The sound 80 dB becomes physically painful. The loudness

of sound depends on the amplitude. When the amplitude of vibration is large the sound produced is loud, when the amplitude is small the sound produced is feeble.

Integer Answer Type

- 1. (4): Displacement = 1.32 km = 1320 m Velocity of sound = 330 m s⁻¹ We have velocity = $\frac{\text{displacement}}{\text{time}}$ = $\frac{1320 \text{ m}}{330 \text{ m s}^{-1}}$ = 4 s
- (1): Distance between the wall and the boy *i.e.d* = 165 m

Speed of sound, $v = 330 \text{ m s}^{-1}$ We have, velocity, $v = \frac{@d}{t}$ $\therefore t = \frac{2 d}{v} = \frac{2 \times 165}{330} = 1 \text{ s}$ 3. (7): Speed of sound = 330 m s⁻¹ Speed of light = 3×10^8 m s⁻¹

$$\therefore \quad \frac{\text{speed of sound}}{\text{speed of light}} = \frac{330}{3 \times 10^8} = \frac{33}{3 \times 10^7}$$
$$= \frac{11}{10^7} = 11 : 10^7 \text{ (approx).}$$

$$\therefore x = 7$$

4. (3): Here, distance, S = 513 m speed of sound = 342 m s⁻¹ time taken by sound to travel

$$=\frac{513 \text{ m}}{342 \text{ m s}^{-1}}=1.5 \text{ s}$$

Time taken by echo to return = $1.5 \times 2 = 3$ s

5. (3): Distance travelled = 1000 mSpeed of sound = 330 m s^{-1} .

Time taken by the wave to movethrough 1 km

$$=\frac{\text{distance}}{\text{speed}} = \frac{1000 \text{ m}}{330 \text{ m s}^{-1}} = 3.03 \approx 3 \text{ s}$$
