SOUND

INTRODUCTION: Throughout the day, we listen the various types of sounds like our father's voice, our mother's voice, our teacher's voice, chirping of birds, ringing of a school bell a telephone ringing, a guitar being played, a siren, a jet engine roaring in the sky, buzzing of a mosquito, a gun, shot etc. These sounds stimulate the auditory nerve in the human ear and the brain interprets the sound, Now let us define sound.

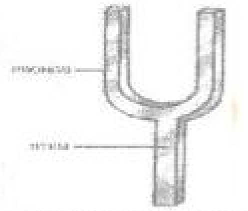
Sound is a from the energy which produced the sernation of hearing in our ears.

PRODUCTION OF SOUND

Perform the following activities to produce sound.

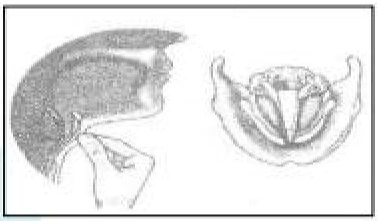
ACTIVITY

1. The a plastic scale or ruler from your geometry box. Hold it flat on your desk to tale with about half its length protruding (stick out fro the surface) over the edge. Now bend it down and release it. Will move up and down rapidly (i.e . it will vibrate) and produce the sound at the same time. The sound will last as long as the vibration

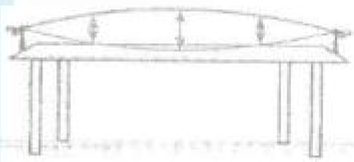


Vibrating Tuning Fork

2. Take a tuning fork. Hold it form its stem and strike it with a rubber pad or hammer. You will observe that the prongs of the tuning fork vibrate and the at same time sound is produced (Figure).



3. Place your finger lightly on your throat near the vocal cords as shown in figure, Now say "AH" for few seconds, You will feel the vibration in your finger as long as you say "An".
4. The thin metallic string rigidly at the two ends f a table as shown in figure. Now pluck the string from the middle and release it . The string begins to vibrate up and down and at the same time, sound is heard.

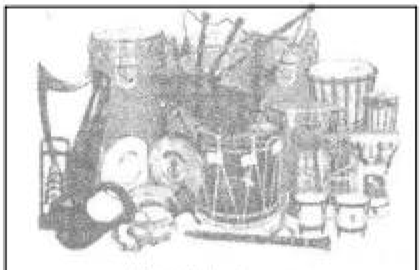


Conclusion. From these activities, we come to the conclusion that the sound is produced by the vibrating object or bodies.

PRODCTION SOUND IN MUSICAL INSTRUMENTS

When a drum beaten, then the skin of drum vibrates and sound is produced.

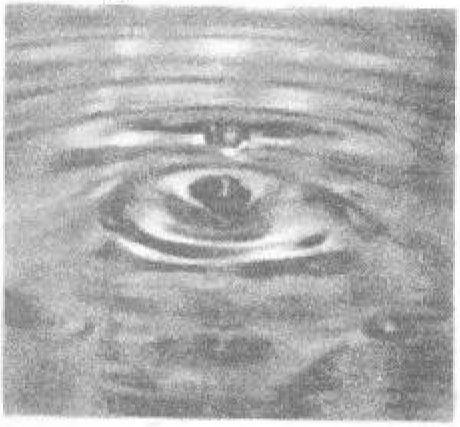
When the strings of a guiter are plucked and released, they vibrate and produce sound. When air is blown into the flute, pipe, clarinet, saxophone etc. it vibrates in the tube of the instrument and hence sound is produced. Sound is also produced when the birds flap their wings during the flight.



Musical Instruments

WHAT IS WAVE ?

When a pebble is thrown in pond of still water, we observe that ripple known as waves move outward on the surface of water as shown in a figure.



Water Ripples

The movement the disturbance through a medium due to the repeated periodic motion of the particle of the medium about their mean positions is known as a wave.

MECHANICAL WAVE

A mechanical wave is periodic distance which requires material medium (i.e. solid, liquid or gas) from its propagation.

In other words. Waves that the characterized b the motion of particles of a medium called mechanical waves.

Examples of mechanical waves.

(i) Sound waves in air

(ii) Water waves

(iii) Waves produced due to the earthquake (Known as seismic waves)

(iv) Waves produced by supersonic jet planes (Known as shock waves)

(v) Waves produced in a stretched string.

(vi) Waves produced in a slinky long spring.

TYPES OF WAVES

Wave are of two types :

(i) Transverse wave

(ii) Longitudinal wave

TRANSVERS WAVE

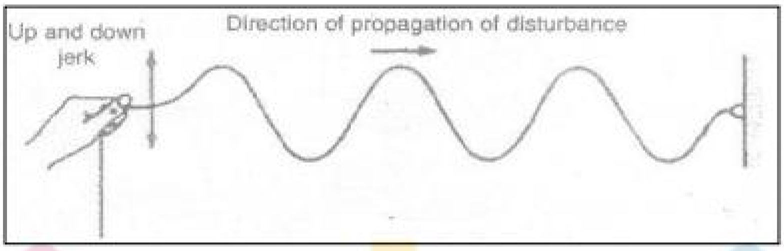
.f the particles of a medium vibrate or oscillate about their position at right angles to the disturbance then the wave is called transverse wave.

ACTIVITY

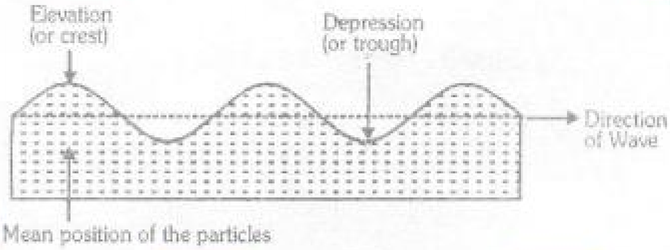
Describle and activity to show the formation of a transverse wave.

Fix one and of a thin rope and give up the down jerk to the free and to the rope.

The rope osciilates or vibrates up and down as shown in figure. The disturbance travels form the free and to the fixed and but the rope vibrated up and down. This wave is known as transverse wave.

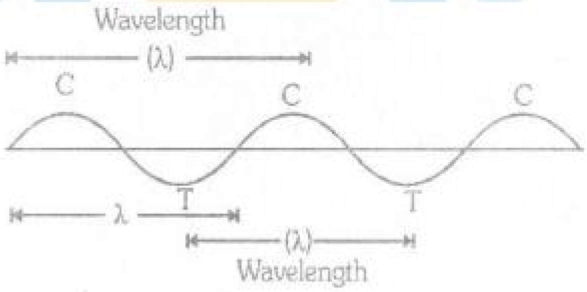


A transverse wave traveling on the surface of water is shown in figure.



When transverse wave travels through the medium, the shape of the medium changes. At some positions. The particles of the medium go down (or depressed) below their mean positions…

The point on the elevation of the medium whose distance from the mean position is maximum is known as crest (C). On the other hand, the point on the depression of the medium whose distance from the mean position is maximum is know as trough (T). Thus crests and troughs are formed when a transverse wave travels through a medium (Figure).]



WAVELENGT (OR LENGTH OF A WAVE)

The distance between tow successive crests or between two successive trough is known as the **wavelength** of a transverse wave.

Or

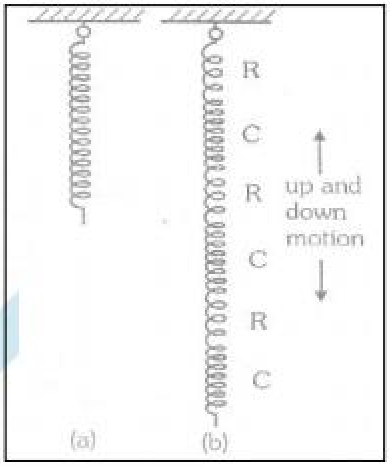
The distance between two successive particles the medium which are is called **wavelength** of the wave. It is denoted by λ (lambda)

LONGITUDINAL WAVE

If the particles, of a medium vibrate or oscillate to and fro about their mean positions along the direction of propagation of the disturbance then the wave is called **longitudinal wave.**

ACTIVITY

Describe an activity to show the formation of longitudinal wave. Take a slinky or long which can be easily with a and extended as shown in figure (a). Fix one end of the slinky with a rigid support. Now push the free and of the slinky in the downward direction and release it. It is observed that the slinky begins to move up and down (i.e. "to and fro") as shown in figure (b). The disturbance travels from the free end to the fixed end the parts of the slinky vibrate along the direction of the propagation the disturbance. This wave is known as
longitudinal wave.



When a longitudinal wave passes through a medium, the medium is divided into the region of compressions (C) and rarefaction (R) as shown in figure (b).

COMPRESSION. The part or region of a medium where the density of the medium is maximum or where the particles of the medium are very close the each other is known as compression. It is denoted by C.

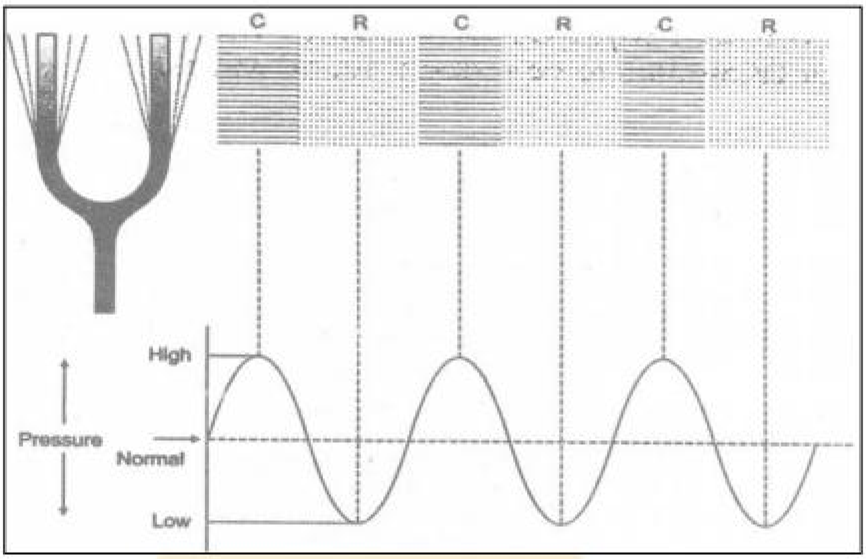
REAEFACTION. The part or region of a medium, where the density of the medium is minimum or where the particle of the medium are far apart from each other is known as rarefaction. It is denoted b R.

Longitudinal waves	Trasuerse waves
1. In a longitudinal was the particles of the medium along the direction of propagation of the wave	1. a transverse wave, the particle of the medium oscillate in a direction perpendicular to the direction of propagation of the Wave
2. Longitudinal waves can propagate through solids liquids as wall as gases.	2. Transverse wave can propagate through solids, and over the surface of liquid, but not through gases.
3. Longitudinal waves consist compressions and rarefactions.	3. Transverse waves consist of crests and troughs.

PROPAGATION OF SOUND

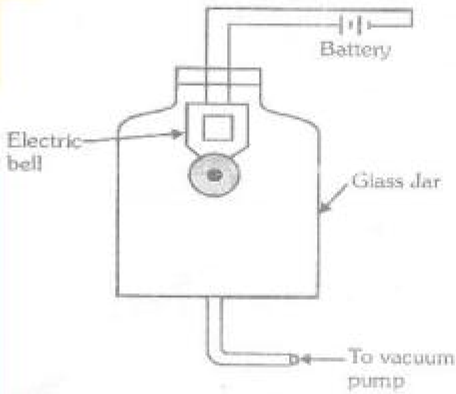
A vibrating body produces sound. Now we shall study, how the sound travels from one place to another place. When a body vibrates, than the particles of the medium (say air) around vibrating body are set into vibtations. The particles of the medium which are very close to the vibrating body pushed away from the body. These particles of the medium strike against the neighbouring particles. Hence the number particle of the medium in the region were the displaced particle strike against the neighouring particles is large. This region is known as compression (C). Since pressure is directly proportional to the number of particles, so the compression is a region of high pressure or high density. When the vibrating body moves backward, a region of emptiness known as rarefaction (R) or a region of a low pressure or Low density is created. The displaced particle of the medium rebound into the region of low pressure or rarefaction. At the same time, compression is followed outwards. Therefore, when body vibrated to produce sound, compression and rarefactions follow one another as the sound waves travel through the' medium away from the vibrating body. When a sound wave travels through a medium. The particle of the medium simple vibrate about their rest positions a hay do not move from one place to another place I the medium.

Figure represents the regions of compression (or high pressures) and o rarefactions (or low pressures) as the sound propagates in the medium



SOUND NEEDS A MEDIUM TO TRAVEL

We have learnt that sound travels from one place to another place when the energy is transferred from one panicle to another particle of a medium like air or gas, liquid, solid ete. It means, sound need s material medium for its propagation. In other words, sound cannot travel through vacuum.



Demonstration to show that sound waves cannot travel through vacuum.

Put an electric bell inside a closed glass jar connected with a vacuum pump. Initially, air from the jar is not taken out. Connect the electric ball with a battery (Figute). It ring and the sound produced is heard by us.

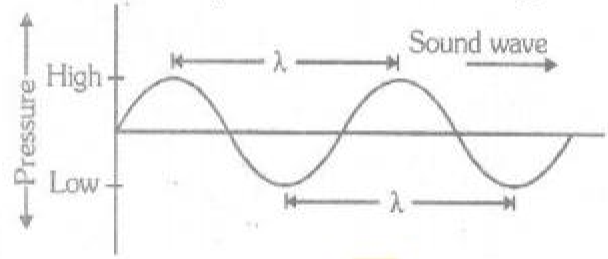
Now start evacuating the air from a glass jar usmg a vacuum pump, we will hear less and less sound. i.e. the loudness of the sound decreases. When there is no air in glass jar, we do not hear sound. This activity demonstrated that sound waves require material medium (in this case air) for its propagation.

SOUND WAVES ARE LONGITUDIANL WAVES.

When a sound wave travels through the material medium, then compressions and rarefactions follow one another. The particle of the medium through which a sound wave travels vibrate to and fro about their mean positions parallel to direction of propagation of the sound wave. Since the wave is know as longitudinal wave, if particles of the medium vibrate to and fro about their mean positions parallel to the direction of propagation of the wave therefore, the sound waves are longitudinal waves.

CHARACTERISTICS OF A SOUND WAVE

When a sound wave travels through a material medium, then the density or pressure of the medium changes continuously from maximum value to minimum value and vice-versa. Thus, the sound wave propagating in a medium can be represented as shown in figute.



Now we shall discuss the characteristics of quantities to describle a sound wave

(i) **AMPLITIUDE.** The maximum displacement of a vibrating body or particle from its rest position. (i.e. mean position) is called amplitude. In S.I. unit of amplitude is mater (m).

(ii) **WEVELENTH (OR LENGT OF A WAVE).** The distance between two successive 1 regions of high pressure or right density (or compression) or the distance between successive regions of low density (or rareftctions) is known as wavelength of a sound wave. It is denoted by λ (read as lambde)

(iii) **FRIQUECY .** The number of oscillations or vibrations made by a vibrating body or particles of a medium in on second is known as the frequency of a wave. It is denoted by v (read as Neu). In S.I. unit of frequency is hertz(Hz) 1 hertz = one oscillation completed by a vibrating body or a vibrating particle in one second.

(iv) **TIME PERIOD.** Time taken by a vibrating particle or a body to complete one vibration or oscillation is known as period. It is denoted by T.

In S.I. unit of time period is second (s). s

Relation between of oscillations completed T second = 1

The number of oscillations completed in 1 second = $\frac{1}{T}$

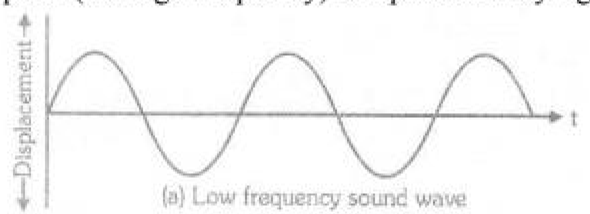
But number of oscillations completed in 1 second = frequency (v)

$v = \frac{1}{T}$, frequency = $\frac{1}{\text{Time period}}$

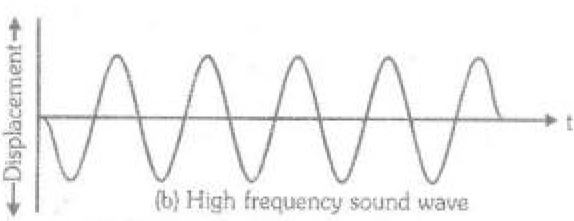
(iv) **PICHI OR SHRILLNESS.** Pitch is the characteristic (i.e. typical feature) of a sound depends on the frequency received by a human ear.

A sound wave of high frequency has high pitch and sound wave of low frequency has a low pitch you most have noticed that the voice of as women has higher pitch that the voice of man. Thus the frequency of women's voice is high than the frequency of man's voice.

A sound wave of low pitch (I.e. low frequency) is represented by figure (a) and a sound wave of high pitch (i.e. high frequency) is represented by figure (b)

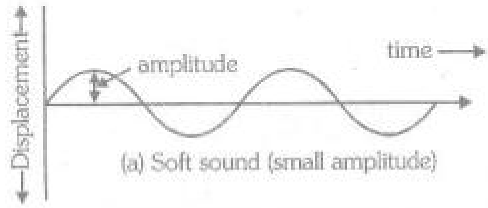


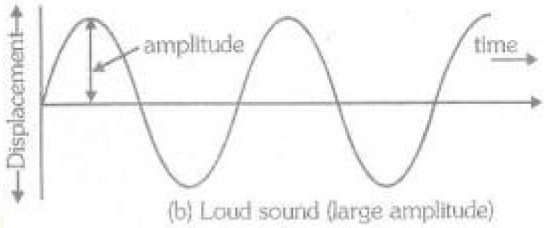
(a) Low frequency sound wave



(b) High frequency sound wave

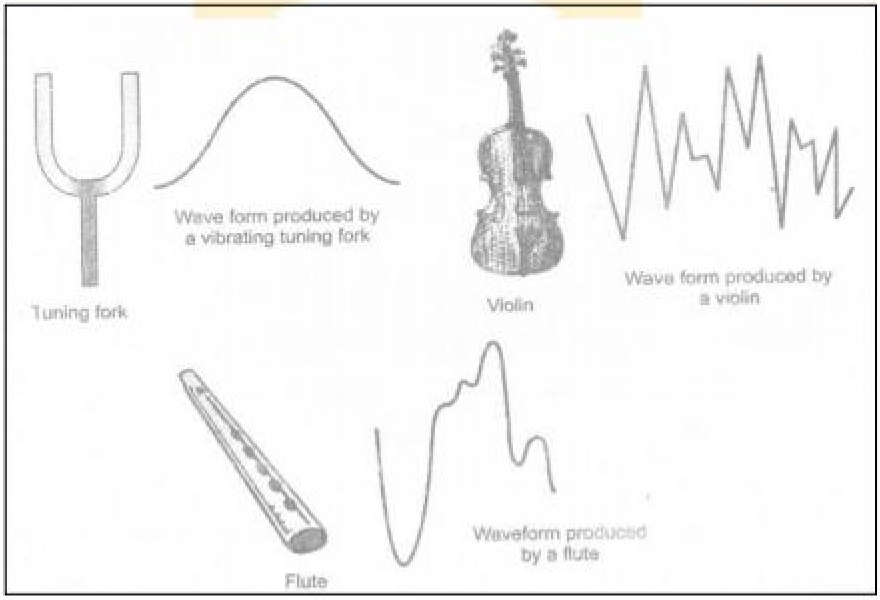
(v) LOUDNESS. Loudness of a sound depends on amplitude of the vibrating body producing the sound. A sound produce by a body vibrating with large amplitude is a loud sound. On the other hand, a sound produced by body vibrating with small amplitude is a feeble or soft sound. Loud sound and soft or feeble sound are represented as shown in Figure (a) and (b) respectively.





LOUDNESS IS A SUBJECTVIE QUANTITY. It depends on the sensitivity or the response of our ears A loud sound to a person may be a feeble sound for another person who is hard of hearing

(vi) TIMRE OR QUAITY. Quality or timbre is as characteristic (i.e. a typical feature) of a sound which enables us to distinguish between the sounds of same loudness and pitch.
This characteristic of sound helps up to recognize or friend from his voice without seeing him.
This quality of two sounds of same loudness and pitch produced by two different sources are distinguishable because of different waveforms produced by them. The waveforms produced by a vibrating tuning fork, violin and flute (Bansuri) are shown in figure.



(vii) INTENSITY. Intensity of a sound is defined as the sound energy transferred per unit through a unit area placed perpendicular to the direction of the propagation of sound.

That is intensity of sound = $\frac{\text{Sound energy}}{\text{Time x Area}}$

Intensity of a sound is an objective physical quantity. It does not depend on the response of our ears. In S.I. unit of intensity of sound is joule s^{-1} m^{-2} or watt m^{-2} ($\therefore 1Js^{-1} = 1$ W)

RELATIONSHIP BETWEEN WAVE VELOCIT, FREUENCY, AND WAELENGHT FOR A PERIODIC WAVE

What is the relationship between wave velocity, frequency and wavelength
Form the definition.

$$\text{Velocity} = \frac{\text{Distrace travalled}}{\text{Time taken}}$$

So, for a wave,

$$\text{Wave velocity} = \frac{\text{Distacne travelled by wave}}{\text{Time taken}}$$

A wave takes time equal to its time period (T) to travel a distance equal to its wavelength (λ). So,

$$\text{Wave velocity} = \frac{\text{Wavelength of the wave}}{\text{Time period of the wave}} \text{.............(1)}$$

Or $v = \dfrac{\lambda}{T}$ ....(2)

As per definition.

$$\text{Frequency of the wave. } \nu = \frac{1}{\text{Time period of the wave}}$$

So. Eq. (2) can be written as. Wave velocity = Wavelength of the wave x Frequency of the wave

Or $v = \lambda \times \nu$

MODEL NUMERICALS

1. A gun is fired at a distance. Why is the sound heard after the flash is seen ?

Ans. The velocity of sound in air is 344m/s, whereas the velocity of light is 3×10^8 m/s. So light waves travel much faster then the sound waves. As a result, the sound due to gun fire is heard after the flash seen.

It is due to this reason that during a thunder storm, one sees the light much before one hears the thunder (sound).

2. Which of the following is carried by the waves from one place to another?

(a) mass (b) velocity (c) wavelength (d) energy

Ans. The correct answer is (d).

3. At the surface of the moon, there is not atmosphere. Suppose you and your friend land on the moon. Would you and your friend be talk to each other ? Why ?

Ans. No. Peple cannot talk, on the moon. This is because there is no atmosphere (or medium) on the moon, and the sound needs a medium to travel.

4. Sound needs a medium to travel.

(a) longitudinal (b) transverse

(c) partly longitudinal and partly transverse (d) sometime longitudinal, sometimes transverse

Ans. Sound waves are longitudinal waves. So answer (a) is correct.

5. State two properties to the medium required for wave propagation.

Ans. Any medium required for wave propagation should have the following characteristics.

(i) It should be a material medium.

(ii) The medium should be elastic.

6. The sound waves longitudinal in nature ?

Ans. The sound wave is longitudinal because it propagate is nay material medium as a series of compression and rarefaction.

During the propagation of a sound wave. the particles to the medium back and forth about their mean Position in the direction of sound propagation.

SPEED OF SOUND IN DIFFERENT MEDIA

We have seen above that sound can travel through solids liquids and gases. The question which comes to mind is how fast does sound travel ? Sound travels at different in different media.

The speed of sound depends on the following factor :

- The properties (or nature) of the medium. The order of the speed sound is

Solids > Liquids > Gases

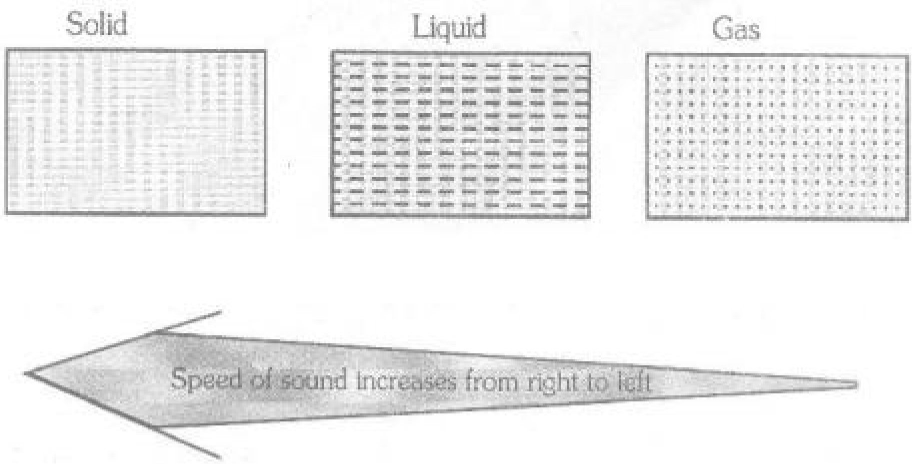
- Temperature
- Pressure
- In any medium, the speed of sound is **increases with** a rise in temperature

As per definition,

$$\text{Speed of sound} = \frac{\text{Dis tan ce tervelled by the sound}}{\text{Time taken}}$$

The speed of light in the air (or more correctly in vacuum) is 3×10^8 m/s (3lakeh kitometre per second)

CONCLUSION . Speed of sound in solids is greater then the speed to sound in liquids and the speed of sound in liquids is greater the speed of sound gases.

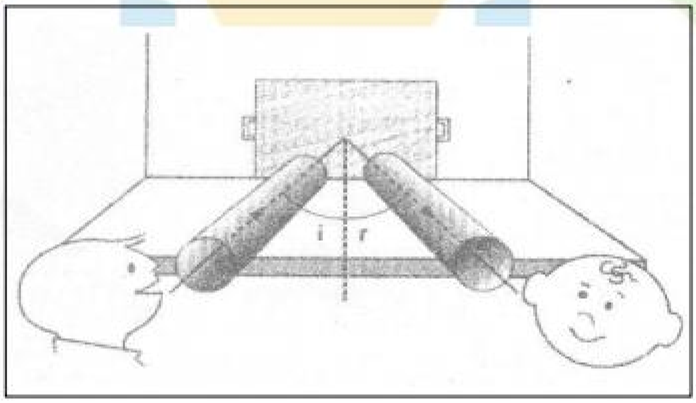


SPEED OF SOUND IN VARIOUS MEDIA

Gases	
Air (0^oC)	331
Air (20^oC)	343
Oxygen (0^oC)	317
Helium (0^oC)	972
Hydrogen (0^oC)	1286
Liquids	
Water (25^oC)	1443
Sea water (25^oC)	1533
Methy alcohol (25^oC)	3560
Blood (37^oC)	5130
Solids	
Aluminium (20^oC)	5100
Copper (20^oC)	3560
Iron (20^oC)	5130
Vulcanized rubber	54
Glass (20^oC)	5170
Granite (20^oC)	6000

REFLECTION OF SOUND

When a sound wave traveling in a medium bounces back to the same medium after striking the second medium, reflection of sound wave. is said to take place. The reflection of sound wave is similar to the bouncing back of a rubber ball after striking a wall or the surface of a floor.



Just like light, sound is reflected by the solid and liquid surface. The reflection of sound obeys the laws of reflection.

The laws of reflection of sound are a following :

(i) Incident angle = Reflection angle and (ii), The direction of sound, reflected direction of sound and the normal to the point of incidence all lie in the same. Plane

ECHO

If we clap hands while standing at some distance from a high and huge wall or hill, we hear the clapping of our hands again after some short interval of time. The sound of clap heard by us known as echo. Echo is produce due to the reflection of sound.

Thus, echo is repetition of sound due to the reflection of original sound by a large and herd obstacle.

1. **TIME GAP BETWEEN THE ORIGINAL SOUND AND THE REFLECTED SOUND**

We can hear the two sounds separately if the time gap between these two sounds is more than 1/10 s or .1 s. heard time interval equal to 0.1 s is known as persistence of hearing. This means, the impression f any sound heard by us remains for 0.1 is our bran if any other sound enters our ears before 0.1 s, then he second sound will no be heard by us. Thus, the echo will be heard if the original sound reflected by bstacle reaches our ears after 0.1 s.

2. **DISTACE BETWEEN THE SOURCE OF SOUND AND OBSTCALE.**

Minimum distance between the observer and the obstacle of echo be heard

Let

Distance between the observer and the obstacle = d

Speed sound (in the medium) = v

Time after which echo is heard = t

Then, $t = \frac{2d}{v}$ or $d = \frac{vt}{2}$

We know

Speed of sound in air at 25°C = 343 m^{-1}

For an echo to be heard distinctly

$t \geq 0.1$ s

Then $d \geq \frac{343 ms^{-1} \times 0.1 s}{2}$

Or $d \geq 17.2$ m

Thus, the minimum distance (in air at 25°C) between the observed and the obstacle for the echo to be heard clearly should be 17.2 m.

The speed of sound increases with a rise in temperature. Therefore, the minimum distance in air between the observer and the obstacle for an echo to e heard clearly at temperature higher then 25°C is more then 17.2m In rooms having walls lass than 17.2m away from each other, no echo can be heard.

3. **NATURE OF THE OBSTACLE**

For the formation of an echo, the reflecting surface or the obstacle. Must be rigid such as a building, hill or a cliff.

4. **SIZE OF THE OBSTACLE**

Echoes an be produced if the size of the obstacle reflecting the sound is quite large.

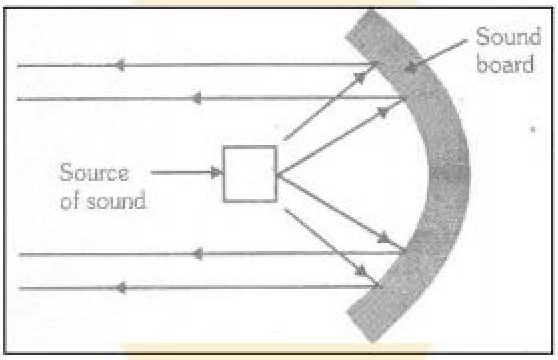
REVERBERATION

The repeated reflection that results in the persistence of sound is large hall is called reverberation .

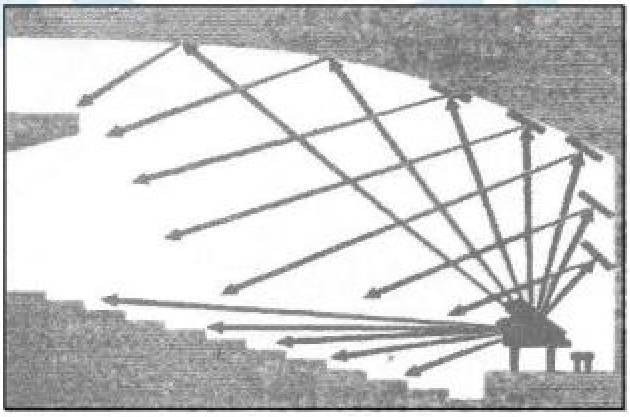
Excessive reverberation in any auditorium/hall is not desirable because the sound becomes blurred and distorted the reverberation can be minimized/reduced by covering the ceiling and walls with sound absorbing materials such as, fiber-board, rough plaster, draperies, perforated carboard sheets etc.

USES OF REFLECTION OF SOUNS

1. **MEGAPHONE.** Megaphone is a used to address public meeting. It is horn-shaped. When we speak through megaphone, sound waves are reflected by the megaphone. These reflection sound wave are directed towards the people (or audience) without much spreading
2. **HERIGN AID.** Hearing aid is used by a person who is herd of hearing. The sound waves falling on hearing aid are concertrated into a narrow bean of sound waves by reflection. This narrow bean of sound waves is made to fall on the diaphragm of the ear. Thus, diaphragm of the ear vibrates with large amplitude. Hence, the hearing power of the person is improved.
3. **SOUND BOARDS.** Sound boards are curved surface (concave) which are used in a big hall to direct the sound wave towards the people sitting in a hall. The speaker is (i.e. source of sound) placed at the focus of sound board as shown in figure.
   Sound waves from the speaker are reflected by die sound board and these reflected waves are directed towards the people (or audience)



4. **STETHOSCOPE.** Stethoscope is a device used by doctor to listen the sound produced by heart and lungs. The sound produced by hearth beat and lungs of a patient reaches Sc the ears of a doctor due to multiple reflection of sound.
5. **CHILINGE OF CONCRET HALLS ARE CURVED.** The ceiling of concert halls and auditoriums are made curved. This is done so that the sound reaches all the parts of the hall after reflection from the ceiling shown in figure. Moreover, these ceilings are made up of sound absorbing materials to reduce the reverberation.



RANG OF HAERING (AUDIBLE RANGE)

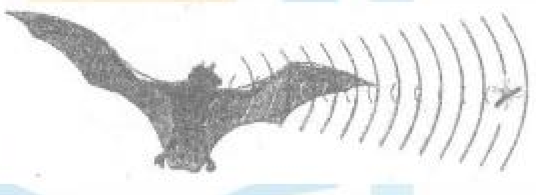
All vibrating bodies produce waves. Each wave has its frequency of a wave is equal to the frequency of the vibrating body producing sound. when a women speaks, the waves produced by the vocal cords in her throat have difference frequency then the frequency of the waves produced by vocal cords f a man. Can human ears hear can hear all the frequency produced by the vibrating bodies ? the answer is No. In fact, normal human ears can hear only those wave whose frequency lies between 20 Hz and 20.000 Hz. **The waves having frequency between 20 Hz and 20.000 Hz are known as sound waves. Thus, the audible range of frequency is 20 Hz to 20.000 Hz.**

INFRASONIC OR LNTRASOUND

The waves of frequency **less then** 20 Hz known as infrasonic waves.
The infrasonic waves are produced by large vibrating bodies.
For example, infrasonic waves are produced by the vibration of the earth's surface during the earthquake. Some animals like elephants, rhinoceroses and whales etc. also produce infrasonic waves. These waves are not audible to a human ear.
It has been observed that animals behaviour becomes unusual before the tremor is felt. This is between the animals has the ability to detect infrasonic waves produced at the time of tremor.

URASONICS OR ULTARASOUND

The waves of frequency **greater then 20,000 Hz** are known as ultrasonic waves or ultrasound. These waves are not audible to a human ear but they can be heard by animal and birds.
Bats can produce by the bats after reflection from their wings. They can also detect these waves. The ultrasonic waves produced by the bats after reflection from the obstacles like buildings guide them to remain away from the obstacles during their flight. Hence, they can flu during night without hitting the obstacles. Bats also catch their pre during with the help of ultrasonic waves. The ultrasonic waves produced by a ….. out. These waves after reflecting from a prey sayan insect reach the bat. Hence the bat easily locate its prey. Dolphins also produce ultr.lsonic waves. They can also detect the ultrasonic waves. They catch their prey like a fish due to their ability to detect the ultrasonic waves reaching them after reflecting from a fish.



APPLECTION OF ULTRASOUND (ULTRAONIC WAVES)

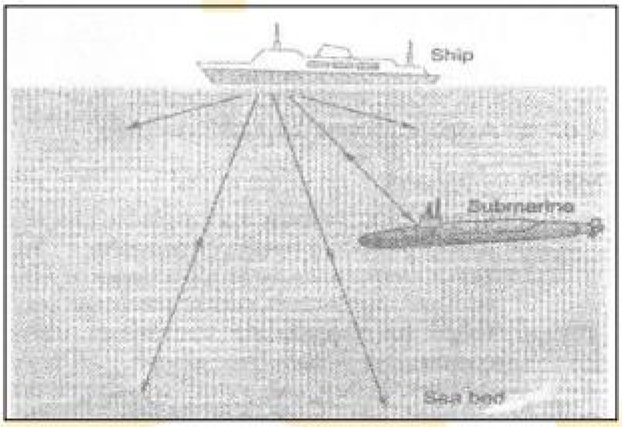
Ultrasonic waves have number of uses:

1. Ultrasonic vibrations are used to for homognising milk i..e. milk is agitated with ultrasonic vibrators. These vibrations break down the larger particles of the fat present in milk to smaller particlek.
2. Ultrasonic vibrations are used in dish washing mashing. In such machines, water and water and detergent are vibrated with ultrasonic vibrators. The vibrating detergent detergent particles rub against the dirty utensils and thus clean them.
3. Ultrasonic vibrations produce a sort f depression in rats and cockroaches. Ultrasonic vibrators are use to drive rate and cockroaches from godowns.

4. Ultrasonic vibrations used for imaging internal organs of human body. In fact they are even used to study the growth of foetus in mother's womb.
5. Ultrasonic vibrations are used in relieving pain in joint sand muscles.
6. Ultrasonic vibrations are used in detecting flaws in article made from metals. They are also used in finding the thickness of various parts of metallic component.

SONAR

SONAR stands for sound Navigation and Ranging.
It is a devise which is used in the ships to locate rocks, icebergs. Submarines, old ship sank in sea ete. It is al 0 used to measure the depth of sea.



PRINCIPLE. It is based on the principle of the reflection of sound wave (i.e. echo)
Determination of the Depth of a sea using Sonar
A bean of ultrasonic waves from the transmitter of a SONAR fitted on the ship is sent towards the bottom of the sea. This bean reflected back from the bottom of the sea and is received by the receiver of the SONAR on the ship
The time taken by the ultrasonic waves to go from the ship to the bottom of the sea and them back to the ship is noted. Let it be 't' second. Therefore, the time taken by the ultrasonic waves to go from the ship to the bottom of the sea is $\left(\frac{1}{2}\right)$seconds.

Using the following formula s = v $\left(\frac{1}{2}\right)$. we can find the depth of the sea.

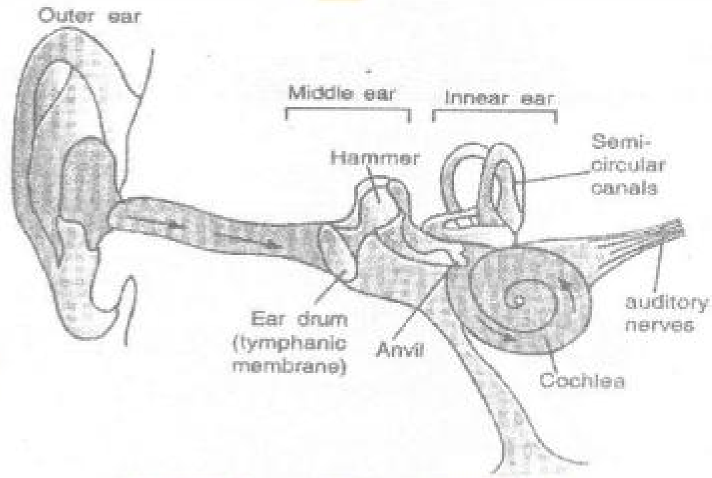
Here u = speed of ultrasonic wave in water.
s = depth of the sea

THE HUMAN EAR

In this article we will learn about the acoustics of hearing. We will see how a human ear converts sound energy into mechanical energy and then to nerve impulse which is transmitted to the brain.
The human ear consists of (a) the outer ear (pinna), (b) the middle ear. (c) the inner ear. Each part has a specific take to perform. The outer ear, collects the sound and guides it to the middle ear. In the middle sound energy is converted into mechanical energy in the for of internal vibrations of the bdne structure. These vibration are then transferred into the inner ear which converts the vibrations into nerve impulses.
The outer ear has an approximately 2 cm tong ear canal. Here the sound is collected and amplified. It is in the form of pressure waves with alternate high pressure and low pressure regions.

The middle ear consists of eardrum (tympanic membrane) three tiny inter connected bones-the hammer (mallens). Anvil (incus) and stirrup (stapes.) . The eardrum is a tightly stretched membrane. As the incoming pressure wave from the outer ear strikes, the ear drum starts to vibrate. A compression force the eardrum inwards whereas a rarefaction force the eardrum outwards. This mean that the eardrum vibrates at the same frequency as the of the sound waves. The eardrum is connected to hammer which in turn is connected to anvil and stirrup. The motion of eardrum will set the hammer, anvil and stirrup into motion at same frequency as the of eardrum. The three-bone system amplifies the sound further.

The stirrup is connected to the inner ear which consists of cochlea semi circular canals and the auditory nerve. The vibrations are turned into electrical signals in inner ear which are sent to the brain via the auditory nerve. The brain interprets the sound by the electrical impulses it receives.



Some suggestion to keeps the ears healthy are given below :

Never insert any pointed object into ear. It can damage the eardrum and make a person deaf.

Never shout loudly or produce a loud sound into someone's ear.

Never hit anyone hard on his/her ear.

SOLVED EXAMLES

1. A Source of wave produces 40 crests and 40 troughs in 0.4 second. Find the frequency of the wave

Sol. Number of crests and trough produced by the wave = 40

Number of waves formed = 40

Time taken = 0.4s

Frequency = ?

Number of waves produced in one second = $\frac{40}{0.4s}$ = 100 s^{-1}

Frequency of the wave = 100 Hz

2. A person has a hearing range fro 20 Hz to 20 kHz. What are the typical wavelengths of sound waves in air corresponding to these two frequencies ? Take the speed of sound in air as 344 m s^{-1}

Sol. Hearing range = 20 Hz to kHz = (=2000Hz)

Speed of sound in the air = 344 m s^{-1}

For a wave

$$\text{Wavelength} = \frac{\text{Wave velocity}}{\text{Frequency}}$$

or $$\lambda = \frac{v}{v}$$

So, for $v = 20$ Hz = 20/s

$$\lambda = \frac{344ms^{-1}}{20S^{-1}} = 17.2m$$

and for $v = 20000$ Hz = 20000 s^{-1}

$$\lambda = \frac{344ms^{-1}}{20000S^{-1}} 0.172m = 1.72\text{ cm}$$

3. Calculate the wavelength of a sound wave whose frequency is 220 Hz and speed is 440 m/s in given medium

Sol. Frequency, v = 220 Hz

Speed of sound, v = 440 m/s

The wavelength can be described by the relationship

Wave velocity = Wavelength of the wave x Frequency of the wave

$440\text{ m s}^{-1} = \lambda \times 220\text{ Hz} = \lambda \times 220\text{ s}^{-1}$

So $$\lambda = \frac{440ms^{-1}}{220s^{-1}} = 2\text{ m}$$

Therefore, wavelength of the sound wave is 2 m.

4. A person is listening to sound of 50 Hz sitting at a distance of 450 m form the source of sound What is the time interval between successive compression from the source reaches him ?

Sol. Frequency if the sound = 50 Hz

Distance form the sound = 450 m

Time between the successive compression is equal to time taken by sound to travel a distance equal to its wavelength. Thus, we have to find out the time period we know.

Time period we know,

$$\text{Time period, } T = \frac{1}{\text{Frequency (v)}}$$

So $$T = \frac{1}{50Hz} = \frac{1}{50s^{-1}} = 0.02\text{ m}$$

The successive compression will reach the person after every 0.02 s.

5. A human heart, on an average is found to beat 75 times a minute. Calculate its frequency

Sol. No of beat of human heart = $75\text{ min}^{-1} = \frac{75}{1min} = \frac{75}{60s} 1.25\text{ s}^{-1}$

So, Average frequency of human heart beating = 1.25 s^{-1}

6. A boat at anchor is rocked by waves whose consecutive crests are 100 m apart. The wave velocity of the moving crests is 20 m/s. What is the frequency of rocking of the boat ?

Sol. Distance between two consecutive crests = 100 m

Wave velocity v = 2 m/s

The distance between two consecutive is equal to the wavelength of the wave SO,

$$\text{Frequency} = \frac{\text{Wave velociyt}}{\text{Wave lenght}} = \frac{20\,m/s}{100m} = 0.2\ s^{-1}$$

7. A longitudinal wave is produced on a toy slinky. The wave travels at a speed of 30 cm/s and the frequency of the wave is 20 Hz. What is the minimum separation between the consecutive compression of the slinky ?

Sol. Wave speed, v = 30 cm/s

Frequency of the wave, $v = 20Hz = 20\ s^{-1}$

The minimum separation between the consecutive compression is equal wavelength. Therefore.

$$\text{Wavelength} = \frac{\text{Wave Speed}}{\text{Frequency}} = \frac{30\ m/s}{20\,s^{-1}} = 1.5\ cm$$

Thus, the minimum separation between consecutive compression of the slinky is 1.5 cm.

8. A bat can hear sound at frequencies up ot 120 kHz. Determine the wavelength of sound in the air at this frequency. Take the speed of sound in the as 344 m/s

Sol. Frequency, $v = 120\ kHz = 120 \times 10^3\ Hz = 120 \times 10^3\ s^{-1}$

Velocity of sound I the air, v = 344 m/s

Wavelength of the sound wave, λ = ?

We know.

$$\text{Wavelength, } \lambda = \frac{\text{Wave velocity}}{\text{Frequency}} = \frac{30\ m/s}{120 \times 10^3 s^{-1}}$$

$= 2.87 \times 10^{-3}\ m = 0.29\ cm$

9. A gun is fired in the air at a distance of 660 m, from person. He hears the sound to the gun after 2 s . What is the speed of sound ?

Sol. Distance traveled by sound = 660 m. Time taken by the sound = 2 s, Speed of sound in air = ?

So, $$\text{Speed of sound} = \frac{\text{Distance trtavelled by sound}}{\text{Time taken by the sound}}$$

$$\text{Speed of sound} = \frac{660m}{2s} = 330\ m/s$$

Thus, the speed of sound in the air is 330 m/s

10. A child hears an echo from a cliff 4 second after the sound from powerful cracker is produced . How far away is the cliff from the child ? Velocity of sound in air at 20°C is 344 m/s.

Sol. Let the distance between the child and the cliff be d. Then,

Total distance traveled by the sound = 2d

Total time taken by the sound = 4s

Then,

Velocity of sound = $\frac{2d}{4s} = \frac{d}{2s}$

344 m/s = $\frac{d}{2s}$

This given, d = 344 m/s × 2s = 688 m

Thus, the cliff is at a distance of 688 m from the child.

11. A ship sends on a high frequency sound wave and receives an echo after 1 second. What is the depth of the sea ? speed of sound in water is 1500 m/s

Sol. Let,

Depth of the sea = d

So, Total distance traveled by the sound wave = 2d

Time taken by sound to travel both ways = 1 s

As per definition.

Speed of the sound = $\frac{\text{Total distacne traveliled}}{\text{Time taken}}$

Then, 1500 m s^{-1} = $\frac{2.2s}{2}$ 1.1s

Distance of the whale = d ?

Form the literature speed of sound in sea water at 25°C = 153 m s^{-1}

So, Distance of the whale, d = speed of the signal × Time taken

Or d = 1533 m s^{-1} × 1.1 s = 1686.3 m

13. Using the SONAR, sound pulses are emitted at the surface of water. These pulses after being reflected from the bottom are detected. If the time interval from the emission in to the detection of the sound pulses is ? 2 seconds. find the depth of the water. Velocity of sound in water = 1498 m/s

Sol. Let, depth of the water for the earth's surface be d. then

Total distance traveled by the pulse = 2d

Total time taken by the pulse = 2 s

As per definition,

Velocity = $\frac{\text{Dis tan ce travelled}}{\text{Time taken}}$

So, Velocity of the sound = $\frac{2d}{2s} = \frac{d}{1s}$

1498 m/s = $\frac{d}{1s}$

This given,

D = 1498 m/s × 1s = 1498 m

Thus, the dept of water is 1498 m.

14. A wave moves a distance of 8 m in 0.05 s.
(a) Find the velocity of the wave
(b) What is the wavelength of the wave its frequency is 200 Hz ?

Sol. (a) Velocity = $\frac{\text{Dis tan c}}{\text{Time}} = \frac{8}{0.05} = 160 \text{ ms}^{-1}$

(b) $v = v\lambda$ $\quad \therefore \quad \lambda = \frac{v}{v} = \frac{160}{200}$ 0.8m

15. Two children are at opposite ends of an iron pip. One strikes his end of the iron pipe with a stone. Fine the times taken by the sound waves in air and iron to reach the other child. Given velocity of sound in air is 344 m^{-1} and that in iron is 5130 ms^{-1}

Sol. For air $V_a = \frac{x}{T_a}$ ....(1)

Where V_a is velocity of sound in air
And T_a is the time taken for the sound to travel in air through the length of pipe x.

For pipe $\quad V_p = \frac{x}{T_p}$ ....(2)

Where v_p is the velocity of sound in iron pipe.
T_p is the taken for the sound to travel in iron pipe through the length of pipe x On dividing (1) and (2).

$$\frac{v_a}{v_p} = \frac{x / T_a}{x / T_p} = \frac{T_p}{T_a}$$

$$\frac{T_p}{T_a} = \frac{5130}{344} = 14.9$$

In other words, according to the example, sound travels 14.9 tie through iron than through air.

16. A boat at anchor is rocked by waves whose consecutive crests are 100 m apart. The wave velocity of the moving crests is 20 mfs. What is frequency of rocking of the boat ?

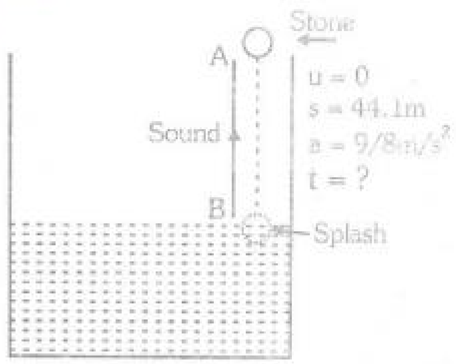
Sol. Given $\lambda = 100$, $v = 20$ m/s

Now $v = v\lambda$

$V = \frac{v}{\lambda} = 0.2$ Hz

17. A stone is dropped in a wall 44.1 m deep. The splash is heard 3.13 seconds after the stone is dropped . Find the velocity of sound in air.

Sol. Stone falling from A to B
$u = 0$, $S = 44.1$ m, $a = 9.8 \text{ ms}^{-2}$. $t = ?$



$s = ut + \frac{1}{2}at^2$

$44.1 = \frac{1}{2} \times 9.8 \times t^2$

$\therefore \quad t = 3$ s

Sound produced at B, due to sound produced by the stone falling on the surface of water, travels form B to A. The sound moves with constant velocity.

Speed = $\frac{\text{distacne}}{\text{Time}}$

$v = \frac{44.1}{v}$

It is given that the total time is 3.13 second.

i.e. $t + t' = 3.13$

$\therefore \quad 3 + \frac{44.1}{v} = 3.13$

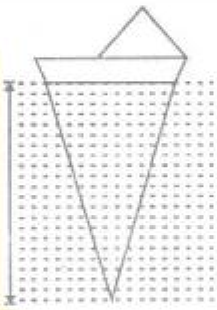
$\Rightarrow \quad \frac{44.1}{v} = 0.13$

$\Rightarrow \quad v = \frac{44.1}{0.13} = 339.2 \text{ ms}^{-1} \text{ s}$

18. Using sonar, sound pulses are emitted at the surface of water. These after being reflected from water bottom are detected. If the time interval from the emission to detection of the sound pulse is 2 seconds find the detection of the sound pulses is 2 seconds. find the depth of the water. [speed of sound in water = 1531 m/s given].

Sol. $t = 2$ s

Speed = $\frac{\text{Ditsance}}{\text{Time}}$



$1531 = \frac{2x}{2}$

$x = 1531$ m.

1. Sound energy is basically.

(A) mechanical energy (B) electromagnetic energy

(C) potential energy (D) electrical energy

2. The transfer of energy in a material medium due to the periodic motion of its particles is called:

(A) wave fornt (B) wave motin (C) pulse (D) none of the above

3. Which is not the condition for nearing sound ?

(A) There must be a vibrating body capable of transferring energy

(B) There must have a large density

(C) There medium must have a large density.

(D) There must be receiver to receive the energy and interpret it.

4. An instrument commonly used in laboratory to produce a sound of some particular frequency is

(A) sonar (B) electric ball (C) tuning fork (D) a stretched wire

5. The sound waves in a medium are characterized by the :

(A) liner motion of particles in the medium

(B) rotatroy motion of particle in the medium

(C) Oscillatroy motion of particle in the medium

(D) none of the above

6. The sound wave which travel in the air are called.

(A) transverse wave (B) longitudinal waves

(C) polarized wave (D) none of the above

7. When a sound wave travels in the air, the physical quantity which is transferred from one place to the other is :

(A) mass (B) force (C) momentum (D) energy

8. In case of longitudinal wave, the particles of medium vibrate :

(A) in the direction of wave propagation

(B) opposite to direction of wave propagation

(C) at right angle to the direction of wave propagation

(D) none of the above

9. In case of transverse wave the particles of a medium vibrate :

(A) In the direction of wave propagation

(B) opposite to the direction of wave propagation

(C) at the right angle of direction of wave propagation

(D) none of the above

10. A longitude wave consists of :

(A) crest and troughs in the medium (B) compression and rarefactions in the medium

(C) both (A) and (B) (D) neither (A), nor (B)

11. A transverse wave consists of :

(A) crests and troughs in the medium (B) compressions and rarefaction in the medium

(C) both (A) and (B) (D) neither (A), nor (B)

12. The longitudinal wave can propagate only in :

(A) solids (B) liquids (C) gases (D) all the above

13. The transverse wave can propagate on only in :

(A) liquids (B) gases (C) solids (D) vacuum

14. A part of the longitudinal wave in which particle of medium are closer then the normal particle is called :

(A) rarefaction (B) crest (C) trough (D) compression

15. In the compression region of the medium cases of longitudinal wave :

(A) the volume monetarily decreases (B) the density momentarily

(C) the pressure monetarily increases (D) all the above

16. A part of longitudinal wave in which particle of medium are father away then the normal particles is called:

(A) rarefaction (B) trough (C) compression (D) crest

17. In case of longitudinal wave, in the region of rarefaction :

(A) the volume of momentarily increases

(B) the density momentarily decreases

(C) the pressure momentarily decreases

(C) all the above

18. In the region of compression or rarefaction, in a longitudinal wave the physical quantity which does not change is :

(A) pressure (B) mass (C) density (D) volume

19. A slinky can produce in laboratory :

(A) transverse wave only

(B) longitudinal wave only

(C) both (A) the (B)

(D) none of the above

20. In case of transverse wave :

(A) the hump on the + y axis is called crest

(B) The hum on the – y axis is called crest

(C) the highest point on the hump on + y axis is called crest

(D) the highest point on the hump on the – y axis is called crest

21. In case of transverse wave :

(A) the hump on the – y axis is called trough

(B) the lowest point the hump on the – y axis is called trogh

(C) the hump on + y axis in called trough

(D) the highest point on the hump on the + y axis is called trough

22. The wavelength is the liner distance between the :

(A) two consecutive compressions

(B) two consecutive rarefactions

(D) one compression and one rarefaction

(D) both (A) and (B)

23. In case of transverse wave the wavelength is the linear distance between :

(A) two consecutive troughs (B) two consecutive crests

(C) one crest and one trough (D) both (A) and (B)

4. The change in density/pressure of medium from maximum value of the minimum value and again to maximum value, due to the propagation of a longitudinal wave is called complete :

(A) oscillation (B) frequency (B) amplitude (D) none of the above

25. The number oscillations passing through a point in unit time is called :

(A) vibration (B) frequency (B) wavelength (D) none of the above

26. The SI unit of frequency is :

(A) hertz (B) gauss (C) wavelength (D) none of the above

27. If the frequency of a wave is 25 Hz, the total number f compression and rarefaction passion through a point in 1 second is

(A) 25 (B) 50 (C) 100 (D) none of the above

28. Time period of a wave in a medium is the time taken by :

(A) a compression to pass through a point

(B) a rarefaction of pass through a point

(C) an oscillation to pass through a point

(D) none of the above

29. Amplitude of pass wave in point

(A) is the extent of which a medium gats compressed

(B) is the extent of which ka medium gats rarefied

(C) either (A) or (B)

(D) none of the above

30. Non – mechanical (electromagnetic) wave can propagate in :

(A) material medium as wall as vacuum (B) in vacuum, but not I material medium

(B) in material medium but not in vacuum (D) neither in material medium nor in vacuum

31. The linear distance between a compression and a rarefaction or a crest and trough is :

(A) $\frac{\lambda}{2}$ (B) $\frac{\lambda}{4}$ (C) λ (D) $\frac{3\lambda}{2}$

32. A longitudinal wave travels in water from west to east. The direction which the particle of medium move.

(A) east of west (B) west to east

(C) north to south (D) south to north]

33. A stretched string is plucked gently to produce a note. The string is producing :

(A) longitudinal wave (B) stationary wave

(C) transverse wave (D) both (A) and (C)

34. A stretched slinky is given a sharp push along its length, A wave travel from one end to another, the wave so produced is :

(A) transverse wave (B) longitudinal wave

(C) stationary wave (D) none of the above

35. A longitudinal sound wave in air consists :

(A) a number of rarefaction pulses one after the other

(B) a number of compression pulses one after the other

(C) compression and rarefaction pulses alternating with each other

(D) a rarefaction pulse followed by compression pulse, separated by some distance

36. The density of air at some point in a longitudinal sound wave is minimum at an instant. The pressure of air at that point is :

(A) minimum (B) maximum

(B) equal t atmospheric pressure (D) none of the above

37. Which of the following is an elastic wave ?

(A) light wave (B) radio waves (C) sound wave (D) microwaves

38. Infrasonic vibrations have frequency :

(A) less then 10Hz (B) less then 20 Hz

(B) between 20 and 20,000 Hz (D) more then 20,000 Hz

39. The range of sonic waves is between

(A) 20 Hz to 2000 Hz (B) 20 Hz ot 10,000 Hz

(C) 20 Hz to 15,000 Hz (C) 20 Hz to 20,000 Hz

40. The sound wave having a frequency more then 20,000 Hz are called :

(A) infrasonic wave (B) supersonic wave

(C) ultrasonic wave (C) hypersonic wave

41. The animal which cannot hear ultrasonic wave is :

(A) bat (B) cow (C) dog (D) dolphin

42. The bat hunts it prey by emitted and receiving reflected:

(A) super sonic waves (B) ultrasonic waves

(C) sonic waves (D) infrasonic waves

43. A sonic boom is produced in the air when an aircraft flies at a speed :

(A) equal to the speed of sound (B) more then the speed to sound

(C) less then the speed of sound (D) climbs vertically

45. A body sitting in a boat fires a gun. An observer P is at a distance of 50 from the boat. Another observer Q is a diver, who is 50 m under water. Both hear the sound f gun:

(A) P hears the sound first

(B) Q hear the sound first

(B) Both P and Q hear the sound at the same time

(D) none of the above

46. When the lightning strikes, we hear multiple of cracks of thunder. These multiple reflections of sound are called :

(A) echoes (B) reverberation (C) resonance (D) none of the above.

47. When the lightning strikes, we hear multiple of cracks of thunder. These multiple reflections of sound celled.

(A) reverberation (B) resonance (C) echo (D) none of the above

48. For hearing an echo the minimum distance should be :

(A) less then the (B) between 10 m and 15 m

(C) 17 m or more (D) none of the above.

49. An echo is heard only, if the original sound after reflection should reach the ear in :

(A) less then $\frac{1}{100}$ s (B) less then $\frac{1}{10}$ s (C) more then $\frac{1}{10}$ s (D) none of the above

50. A bullet is moving at a speed, more then the speed of sound. it is said to be moving at :

(A) supersonic speed (B) ultrasonic speed

(C) infrasonic speed (D) none of the above

51. Naval ships called "destroyers" can detect submarines is the sea. The device used by ships is called:

(A) ultra sonometer (B) sonar (C) ultrasonograph (D) none of the above.

52. Which is the following properties of a sound wave are effected by the change in temperature of air :

(A) frequency (B) amplitude (C) wavelength (D) intensity

53. Which of the following cases the sound travels fastest :

(A) hydrogen (B) helium (C) nitrogen (D) oxygen

54. The wave used in sonography as :

(A) microwaves (B) ultra-violet waves (C) ultrasonic waves (D) sound waves

55. The crack of thunder is hard after few second the lightning flash, because :

(A) crack of thunder and lightning are not produced at same time

(B) light travels extremely fast as compared to sound

(C) sound waves slow down on passing through air

(D) none of the above

ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	A	B	C	C	C	B	D	A	C	B	A	D	C	D	D
Que.	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Ans.	A	D	B	C	C	B	D	D	A	B	A	B	C	C	A
Que.	31.	32	33	34	35	36	37	38	39	40	41	43	42	44	45
Ans.	A	B	C	B	C	A	C	B	D	C	B	B	B	C	B
Que.	46	47	48	49	50	51	52	53	54	55					
Ans.	B	C	C	C	A	B	C	A	C	B					

SHORT ANSWER TYE QUESTIONS

1. Why are we able to hear the horn of an approaching car before the car reaches us ?

2. Why is flash of lighting from clouds seen much before thunder, although both occur simultaneously ?

3. A human heart, on an average, is found beat 75 tie in minute. Calculate its frequency.

[Ans.125 s^{-1}]

4. Is the speed of wave motion same in all direction ?

5. Why do we get echo in a small room ?

6. Why do we prefer ultrasonic sound over other frequency like X – rays for medium applications ?

7. How does sound produced by a vibration object on a medium reach your ear ?

8. Explain how sound is produced by your school bell ?

9. Why are sound waves called mechanical waves ?

10. Suppose you and your friend are on the moon. Will you be able to hear sound produced by your friend

11. Which wave property determines (a) loudness (b) pitch ?

12. Guess Which has higher pitch: a guitar or a car horn ? **[Ans. A guiter]**

13. What are wave length, frequency, time period and amplitude of sound wave ?

14. How are the wavelength and frequency of a sound wave related to its velocity ?

15. Calculate the wavelength of a sound wave frequency is 220 Hz and speed is 440 m/s in a given medium

16. A person is listening to a tone of 500 Hz sitting at a distance of 450 m from source of the sound. What is the time interval between successive compression from the source ?

17. In which is of the three medium: air, water or iron ; does sound fasted at a particular temperature.

18. An echo returned in 3 s. What is the distance of the reflection surface from the source given that speed of sound is 348 ms^{-1}

19. Why are ceilings of concert halls curved ?

20. What is the audible range of the average human ear ?

21. What is range of frequency associated with (a) infrasound (B) ultrasound?

22. A submarine emits a sonar pulse which returns from an underwater cliff I 1.02 s If. The speed of sound in salt water is 1531 m/s, how far away is the cliff ?

23. What is sound and how is it produced ?

24. Describe with the help of a diagram, how compression and rarefaction are produced in air near a source of sound.

25. Give an experiment to show that sound needs a material medium for its propagation.

26. Why is sound wave called a longitudinal wave ?

27. Which characteristic of he sound helps you to identity your friend by his voice while sitting with others in a dark room ?

28. Lightning and thunder are produced simultaneously. But thunder is head a few second after the flash is seen. Why ?

29. Humans haves has a hearing range from 20 Hz to 20 kHz. What are typical wavelengths of sound waves in air corresponding to these two frequency ? Take the sound of sound in air as 344 ms^{-1}

30. Two children are at opposite ends of an aluminium rod. One strikes the end of the rod with a stone. Find the ratio of time taken by the sound wave in air and in aluminium reach the second child.

31. The frequency of a source of sound is 100 Hz. How many times does it vibrate in a minute ?

32. Does sound follow the same laws of reflection as light does ? Explain.

33. When a sound is reflected from a distant object, an echo is produced. Let the distance between the reflecting surface and the source of sound waves.

34. Give two practical applications of reflection of sound waves.

35. A stone is dropped from the top of a tower 500 m high into a pond of water at the base of the tower. When is the splash heard at the top? Give. $g = 10\ ms^{-2}$ and speed of sound = $340 ms^{-1}$ **[Ans. 11.47 sec]**

36. A sound wave travels at a speed of 339 ms^{-1}. If its wavelength is 1.5 cm what is the frequency of the wave ? will it be audible ? **[Ans. 22600 Hz, not be audible]**

37. What is reverberation? How can it reduced ?

38. What is loudness of sound ? What factors does it depends on ?

39. Explain how bats use ultrasound to catch their prey.

40. How is ultrasound used for cleaning ?

41. Explain the working and application of a sonar.

42. A sonar device on a submarine sends out a signal and receives an echo 5 s later. Calculate the speed of sound in water if the distance of the object from the submarine is 3625m. **[Ans . 1450 m/s]**

43. Explain in defects in a mater block be detected using ultrasound

44. Explain how the human ear works.

45. Which physical quantity is carried a wave ? **[Ans. Energy]**

46. Which of the following are mechanical wave ?

(a) sound wave, (b) light wave, (c) radio wave (d) water wave

47. What kind of waves are the sound waves ?

48. Can sound waves propagate through (a) soiled (b) liquids (c) gases ?

49. Show compressions and rarefaction in a longitudinal wave.

50. Two persons take on the surface of the moon. Will they be able to hear each other ?

51. Sound travels through solid, liquid and gas.

(a) In which medium is the velocity maximum ?

(b) In which medium is the velocity least ?

52. What is the frequency of wave with a time period of 0.05s ? **[Ans. 20 Hz]**

53. How is the wave velocity related to longitudinal and a frequency ?

54. Write down two difference between a longitudinal and a transverse wave.

55. Define the amplitude of a wave. Show it graphically. What does the amplitude of a wave describe? D

56. Show the wavelength of a wave with the help of a diagram.

57. A bat can hear sound of frequency 100 kHz. Find the wavelength of the sound wave in air corresponding to this frequency. Give, speed of sound in air = 344 m^{-1} **[Ans. 3.44mm]**

58. A body 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? **[Ans. time period = 0.01 sec]**

59. The waves are produced at a frequency of 40 Hz. If the wavelength of these wave is 2.5 cm, calculate the speed of the waves. **[Ans. 1m/s]**

60. A radio station transmits waves of wavelength 200 m. if the speed of the waves is 3×10^8 m/s, find the frequency of the radio station. **[Ans. 1.5×10^6Hz]**

61. Calculate the time taken by a sound wave of frequency 1000 Hz and wavelength 50 cm to travel distance of 500 m. **[Ans. T = 15, v = 500 m/s]**

62. Audible rage of frequency is 20 Hz to 20,000 Hz. Find the rage of wavelength corresponding to this frequency. Given, velocity of sound = 340 ms^{-1} **[Ans. λ =17m]**

63. A rock at the band of a coast is struck by water waves. Find the frequency of the wave striking the rock, if the distance between two consecutive crests or troughs is 50 metre. Given velocity of water wave = 50 ms^{-1} **[Ans. 1 Hz]**

64. A long spring whose one end is rigidly fixed is stretched from the other end then left. Longitudinal wave of frequency 10 Hz produced. If the velocity of the wave is 25 ms^{-1}, find the distance between two consecutive compressions in the spring. **[Ans. 2.5m]**

Important Notes