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PHYSICS

Class 10th (KPK)

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Chapter # 11

UNIT #11

SOUND

COMPREHENSIVE QUESTIONS

Give an extended response to the following questions.

Q1. What is sound? How it is produced, transmitted and received?

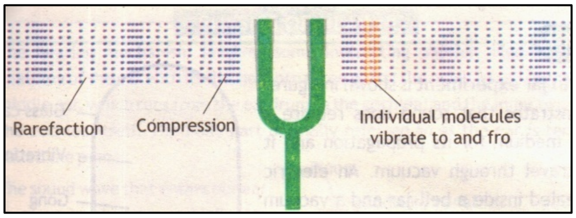
Ans: <u>Sound</u>:

The sensation felt by our ears is called sound.

Explanation:

Sound is the form of energy. It travels through a medium in the form of longitudinal waves. When sound falls on the ear membrane it produces the sensation of hearing.

1. **Production of Sound:**
   Some disturbance and vibration is needed for the production of sound.
   In tuning fork experiment, when the prongs of the tuning fork are struck on a hard rubber pad, the prong vibrates and sound is produced in the form of compression and rarefactions. Buzzing sound of bees and mosquitoes is produced due to rapid vibrations of their wings. Sound in sitar and guitar is produced by vibration of stretched string.



2. **Transmission of sound:**
   Since sound is a longitudinal mechanical wave it also requires the transmitting medium. In tuning fork experiment, the compressions and rarefactions that were produced in air were used to carried sound. The transmitting medium is usually air but sound can also travel through other media. The medium could be solid, liquid or gas. Sound cannot travel through vacuum.
3. **Receiving or Detection of Sound:**
   Sound can be detected by various means; ear is one such biological organ. Ear converts sound waves into perception of hearing.
   Microphones detect sound by converting it to electrical signals. The persons impaired of hearing detects the sound with artificial hearing devices.

Q2. What is audible frequency range?

Ans: <u>Audible Frequency Range:</u>

There are both upper and lower limits to the sound frequencies that humans can hear. A healthy young person can typically hear frequencies in range from about 20Hz to 20,000Hz. The upper limit decreases with age.

Physicists have established a three part classification of sound, based on the range of human hearing.

a. Infrasonic:

Sound frequencies lower than 20Hz are referred to as infrasonic. So, these sounds cannot be heard by human beings. The sounds produced by whales, elephants and rhinoceroses are Infrasonic.

b. Audible sound:

Sound frequencies in 20Hz to 20,000Hz range are audible.

c. Ultrasonic:

Sound frequencies higher than 20,000Hz are known as ultrasonic. So, these sounds cannot be heard by human beings because these are outside the audible range of human. The sound produced by bats. These are very powerful waves and can be used in medical, scientific and industrial fields for various purposes.

Q3. What is the speed of sound?

Ans: <u>Speed of Sound Waves:</u>

The speed of sound is the distance traveled per unit time by a sound wave as it propagates through a medium.

<u>Explanation:</u>

The speed of sound depends upon the material through which it is passes. Sound can be transmitted through any medium solid, liquid or gas. Sound travels most rapidly in certain solids less rapidly in many liquids, and quite slowly in most gases.

The speed of sound 'v' can be found by dividing distance 'S' by time 't' as;

$$speed = \frac{distance}{time}$$

Or

$$v = \frac{S}{t}$$

Sound, like all waves, travels at a certain speed and has the properties of frequency and wavelength. At 20^o C, the speed of sound in air is 343m/s.

We may have watched distant lightening and notice the time laps before the sound of thunder reaches us. This is an example of relatively slow speed of sound compared to the speed of light. The speed of sound in water is almost five times faster than its speed in air.

<u>The Speed of Sound in Air</u>:

The speed of sound in air depends upon the density of air and its compressibility. As temperature is increases, these properties change causing the speed of sound in air to increase with temperature. At a temperature of 0^o C and a pressure of 101 kPa, the speed of sound in dry air is 331 m/s, and for each 1^o C rise in temperature, the speed of sound increases approximately by 0.6 m/s.

Mathematically,

$$v = 331 + 0.6T - - - -(1)$$

Where 'T' is the temperature in ^oC.

Using eq (1), we can calculate the speed of sound in air for given value of ‘T’. for example, if the temperature of air is 20^{o}C, then we put T=20^{o}C in eq (1), so we get

$$v = (331 + 0.6 \times 20)m/s$$
$$v = (331 + 12)m/s$$
$$v = 343m/s$$

Thus the speed of sound in air will be 343 m/s at 20^{o}C.

The general wave equation also applies to sound waves as

$$v = f\lambda - - - - (2)$$

It should be noted that wide range of frequencies observed in sound, and the speed of sound is the same for all frequencies. Thus, in the eq (2) the speed ‘v’ remain fixed. For example, if the frequency of a wave is doubled, its wavelength is halved, so that the speed ‘v’ stays the same.

Q4. Describe the terms loudness, pitch and quality. Explain each by giving an example.

Ans: **Loudness:**

The greater the sound energy, the louder is the sound. The loudness depends upon the amplitude (height) of the sound waves.

Explanation:

The loudness of the sound enables us to distinguish between a faint and the loud sound. Loudness depends upon the following factors.

- **The area of vibrating body**:
  Larger the area of vibration larger will be amplitude of sound produced.
- **Distance from the source of sound:**
  The loudness of a sound increases or decreases as the distance between the source of sound and the listener decreases or increases respectively.
- **Material through which sound is traveling:**
  Amplitude of sound wave is different in different materials such as, water and air.

Example:

A drum produces loud sound if its membrane is struck strongly. This is because the vibrating body starts to oscillate with larger amplitude and therefore the sound it produces also has a larger amplitude and as a result the sound is louder.

Pitch:

The pitch of sound is the characteristic of sound by means of which a shrill sound can be distinguish from a grave sound.

Explanation:

The pitch of a note depends on the frequency of the sound wave reaching the ear. A high pitched note has a high frequency and a short wavelength. A low pitched note has a low frequency and along wavelength.

Example:

The sound produced by man, dogs, frogs etc. are of low pitch whereas the sound produced by women, birds, cats etc. are of high pitch. Pitch is like color in light; both depend on the frequency.

Quality:

The property of sound by which two sounds of the same loudness and pitch are distinguish from each other.

Explanation:

With the help of quality of sound, we can distinguish between sound of one instrument from the sound of another instrument, although they have the same pitch and loudness.

Example:

When a piano and a flute are made to produce sound of same loudness and pitch, we can easily distinguish between the overall sound from piano and flute.

Q5. What is intensity level? Describe the decibels scales for the intensity of different sound levels.

Ans: Intensity Level:

The difference between the loudness of two sounds where one sound is faintest audible is known as intensity level.

Explanation:

An average human ear can detect sound with intensity as low as 10^{-12} W/m^2 and as high as 1W/m^2. This is an incredibly wide range of intensity, spanning a factor of 10^{12} from lowest to highest.

If L is the loudness and 'I' is the sound intensity in W/m^2, then mathematically

$$L \propto logI$$

Or

$$L = klogI \quad ----(1)$$

Where 'k' is the constant of proportionality. If 'L_o' represent the loudness of faintest audible sound of intensity 'I_o' such that $I_o=10^{-12}$ W/m^{2}eq (1) can be written as;

$$L_o = klogI_o \quad ----(2)$$

Subtracting eq (2) from eq (1), we get

$$L - L_o = klogI - klogI_o$$

Or

$$L - L_o = k(logI - logI_o)$$

$$L - L_o = klog\frac{I}{I_o}$$

The difference between the loudness of these two loudness of sound $(L - L_o)$ is called intensity level (β) and is given as

$$\beta = klog\frac{I}{I_o} \quad ----(3)$$

Since β is defined in terms of a similar quantities ratio, it is unit-less. The value of k depends not only on the units of 'I' and 'I_o' but also on the unit of intensity level. If the intensity of any sound is ten times greater than the intensity 'I_o' of the faintest audible sound ($I=10\ I_o$), then the intensity level of such a sound is taken as unit called bel and value of 'k' becomes 1. Substituting k=1, eq (3) becomes

$$\beta = log\frac{I}{I_o}\ (bels)$$

Since bel is a large unit**, the intensity of sound is often expressed in a smaller unit called decibel (dB).** Such that

$$\beta = 10log\frac{I}{I_o}\ (dB)$$

It must be remembered that 1 bel =10 decibels.

Q6. What is noise? Explain why noise is nuisance?

Ans: <u>Noise Pollution:</u>

The excessive displeasing sound which disturbs the balance or activity of humans or other living things is called noise pollution.

Explanation:

The first type of noise pollution involves noises that are so loud they put the sensitive part of the ear. Prolonged exposure to sounds of about 85dB can begin to damage hearing irreversibly. Certain sound above 120dB can cause immediate damage.

The sound level produced by a jet engine from a few meters away is about 140dB. The workers working in noisy areas like an airport use 'headphones' to prevent the hearing loss brought on by damage to the inner ear.

The second king of noise pollution involves noises that are considered annoyances, these sound are irritating and sometimes becomes intolerable. Studies have found that long term exposure to noise can cause potentially severe health problems in addition to hearing loss, especially for young children.

Harmful Effects of Noise Pollution:

Constant levels of noise can be enough to cause stress, which can lead to high blood pressure, insomnia and psychiatric problems, and can even impact memory and thinking skills in children.

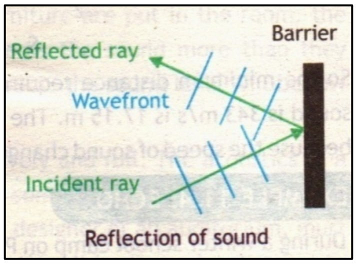
Animals and plants are also victims of noise pollution. It is observed that in animals it damages the nerves system and reproductive system. While in plants growth defects are observed.

Q7. How sound is reflected? Describe the difference between echo and reverberation.

Ans: **Reflection of Sound:**

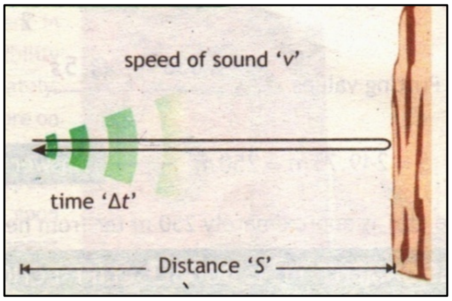
The bouncing back of sound waves when it strikes a surface is called reflection of sound.

Explanation:



As reflection of water wave in ripple tank, sound wave can also be made to bounce back. Some materials, such as hard, smooth surfaces, reflect sound waves more than they absorb them. Other materials, such as soft curtains, absorb sound waves more than they reflect them.

Some people claim that their singing voice is better in the shower than anywhere else. This



If a reflected sound arrives after 0.10s, the human ear can distinguish the reflected sound from the original sound. Besides the hearing of your words repeated, echoes can be used to estimate the distance of an object and the velocity of sound itself. Since the sounds covers a distance 'S' twice 'S=2S' i.e. for going and receiving in time 'Δt'. The speed 'v' is

$$v = \frac{2S}{\Delta t}$$

Or

$$S = \frac{v\Delta t}{2}$$

This means that we can calculate the minimum distance for the echo to be heard.

Reverberation:

"The presence of sound after the sounding source has stopped is called reverberation".

Or

A reflected sound that arrives before 0.10sec is perceived as an increase in volume is called a reverberation.

Explanation:

Sound due to multiple reflections is called a reverberation. The continuation of many reflections causes a tone to gain in volume. Thus reverberation adds to gains in volume of tone. It causes a general confusion of the sound impressions on the ear. It can be prevented if sound absorbing materials are used and curved surfaces are avoided.

Q8. What is acoustic protection? Why is it important?

Ans: **Acoustic Protection:**

Acoustic protection is the application of soft and porous materials to protect individuals against undesirable sounds and noises.

Importance:

Acoustic protection is employed not only for physical health, but for psychological wellbeing as well. Animals and birds have also been reported to express discomfort due to higher noise and sound levels. Acoustic protection is also necessary to minimize stress levels generated due to high noise. Acoustic protection may also be required to protect structures against vibrations generated by objects, such as trains and earthquakes. This is also required to control the noise generated during construction and/or development activities.

Conceptual Questions

Give a brief response to the following questions.

Q1. Why sound produced by a simple pendulum is not heard?

Ans: The waves produced by a simple pendulum not heard because the frequency of these waves is less than 20Hz and the membrane of human ear can only detect those sound whose frequency is greater than 20Hz and below than 20,000Hz. The frequency of waves produced by a simple pendulum is less than 20Hz that is why we cannot hear such sounds of low frequencies.

Q2. If a ringing bicycle bell is held tightly by hand, it shops producing sound. Why?

Ans: When a body vibrates sound is produced due to vibrations. Thus if a ringing bicycle bell is held tightly by hand, it stops producing sound because its vibrations die out and as a result bell will produce no sound.

Q3. Why is the intensity of an echo less than that of original sound?

Ans: The intensity of an echo less than that of original sound because intensity decreases with distance and the sound has traveled from the source to a reflecting surface and back.

When the sound strikes with wall, it imparts some of its energy to the wall. Thus the reflected waves possess less energy and become less intense. Therefore, the intensity of an echo is less intense than the original sound waves.

Q4. In which medium air or water, an echo heard sooner. Why?

Ans: An echo is heard sooner in water as compared to air because the speed of sound depends on the elasticity of the medium. The more elastic a medium the greater will be the speed of sound and vice versa. So water is more elastic than air. The sound will travel faster in water that is why, we heard on echo sooner in water as compare to air.

Q5. Why sound cannot be heard on moon?

Ans: Sound waves are longitudinal waves which needs a material medium for their propagation. In moon atmosphere there is no material medium that is why sound cannot be heard on moon.

Q6. If a person places his ear on rails of railroad for determination of coming train. Why is this done, and how does it work?

Ans: The person places his ear on rails of railroad in order to indicate the coming train earlier because sound travels faster in solids (steel) as compared to air.

In steel the speed of sound is about 4500 m/s while in air it is just 343 m/s (at temperature of 20^oC).

Due to high speed of sound in steel, when ear is placed on the rail, a person may easily hear the sound due to vibration of railroad which indicates the coming train before he see it.

Q7. When you watch a thunderstorm, you see the lightning first, and you hear the thunder afterward. Why is the thunder delayed?

Ans: The thunder light is seen earlier than thunder sound is heard because light travels much faster than sound in air.

Speed of light in air is 3×10^8 m/s whereas the speed of sound in air is 343 m/s. Thus, because of this reason we see the light of thunder much earlier than we hear its sound.

Q8. If the speed of sound is dependent on frequency, would music from marching band be enjoyed?

Ans: No, if the speed of sound is dependent on frequency, then it will not be possible for us to enjoy the music from marching band.

The universal relation for the speed of sound wave is given by

$$v = f\lambda - - - - (1)$$

Eq (1) shows that, the speed of sound is not dependent on the frequency of sound.

If the speed depends upon the frequency of sound, then sound of different instruments (having different frequencies) will be heard at different speeds. This will produce an unpleasant effect on our ear and we get disturbed.

Q9. Why does your voice sound fuller in the shower?

Ans: Mostly our bathroom is made up of tiles or others hard non-absorbent surfaces. Sound reflects better from these types of surfaces. The multiple reflections from these walls enrich the sound and making voice louder and more powerful.

Reverberation also makes the sound richer and fuller. It occurs when our ear picks many echo's in a very short interval of time.

There occurs resonance as well, as a result of which we hear loud sound. It occurs when the frequency of the sound wave produced matches the frequency of the shower.

Due to these effects the sound in a shower is fuller and richer.

Q10. Why is it so quiet after a snowfall?

Ans: Snow is porous and is a good sound absorber. When snow accumulates on the ground, it acts as a sound absorber, damping sound waves like other sound absorbing materials. Snow wraps everything in a thick blanket, which acts as a sound barrier. A very little sound energy is reflected when sound waves hit the snow surface. Due to its porous nature, sound waves enter into its surface and make multiple reflections, due to which considerable amount of energy is absorbed. Thus there is so quite after a snowfall.

ASSIGNMENTS:

11.1 Suppose that when a certain sound intensity level (dB) triples, the sound intensity (in W/m2) also triples. Determine this sound intensity level.

Given data:

Intensity of sound =I=3I_o

Required:

Intensity level=β=?

Solution:

We know that

$$\beta = 10log\frac{I}{I_o} ----(1)$$

Putting values in eq (1)

$$\beta = 10log\frac{3I_o}{I_o}$$
$$\beta = 10log3$$
$$\beta = 10 \times (0.477)$$
$$\beta = 4.77d\text{B}$$

11.2 If the time between seeing lightning and hearing the thunder is 5.0s. The speed of sound is 343m/s, how far away is the lightning?

Given data:

Time=t=5.0sec

Speed of sound =v=343m/s

Required:

Distance of lighting =S=?

Solution:

As we know that

$$S = vt ----(1)$$

Putting values in eq (1), we get

$$S = 343 \times 5.0$$
$$S = 1715m$$

Or

$$S = \frac{1715}{1000}km$$
$$S = 1.715km$$

Or

$$S = 1.7km$$

11.3 What is the frequency of sound with wavelength 0.25m in air with temperature of 32^o C?

Given data:

Wavelength =λ= 0.25m

Temperature =T=32^{o}C

Required:

Frequency=f =?

Solution:

We know that speed of sound in terms of temperature is

$$v = 331 + 0.6T - - - - (1)$$

Putting T =32^{o}C in eq (1), we get

$v = (331 + 0.6 \times 32)m/s$

$v = (331 + 19.2)m/s$

$v = 350.2m/s$

$v = 350m/s$

Now for finding the frequency, we have

$v = f\lambda$

$f = \frac{v}{\lambda} - - - - (1)$

Putting the values in eq (1), we get

$f = \frac{350}{0.25}$

$f = 1400Hz$

11.4 A man stands in between two parallel cliffs and fires a gun; he hears two successive echoes after 3s and 5s. What is the distance between cliffs?

Given data:

Time for first echo =T_1=3s

Time for second echo =T_2=5s

Speed of sound=v=330m/s

Required:

Distance between two cliffs=S=?

Solution:

I. First we find the distance between the 1st cliff and man=S_1=?

Time taken by sound waves to reach the 1st cliff = t_1=$\frac{T_1}{2}$

$$= \frac{3}{2} sec$$

$$= 1.5sec$$

Distance of man from 1st cliff =S_1=?

As we know that

$$S = vt$$

$$\Rightarrow S_1 = vt_1$$

$$\Rightarrow S_1 = 330 \times 1.5$$
$$\Rightarrow S_1 = 495m$$

II. Now, we find the distance between the 2nd cliff and man=S_2=?

Time taken by sound waves to reach the 2nd cliff = $t_2 = \frac{T_2}{2}$

$$= \frac{5}{2} sec$$
$$= 2.5 sec$$

Distance of man from 2nd cliff =S_2=?

As we know that

$$S = vt$$
$$\Rightarrow S_2 = vt_2$$
$$\Rightarrow S_2 = 330 \times 2.5$$
$$\Rightarrow S_2 = 825m$$

Now the distance between two cliffs is given by

$$S = S_1 + S_2$$

Putting values

$$S = (495 + 825)m$$
$$S = 1320m$$

NUMERICAL QUESTIONS

1. **The sound intensity 3m from a jackhammer is 8.20×10^{-2} W/m^2. What is the sound intensity in decibels? (use the usual reference level of $I_o = 1.00\times10^{-12}$W/m^2)**

Given data:

Intensity of sound=I=8.20×10^{-2} W/m^2

Usual reference level= $I_o = 1.00\times10^{-12}$W/m^2

Required:

Intensity level=β =?

Solution:

We know that

$$\beta = 10 log \frac{I}{I_o}$$

Putting values

$$\beta = 10 log \left(\frac{8.20 \times 10^{-2}}{1.00 \times 10^{-12}}\right)$$
$$\beta = 10 log(8.20 \times 10^{10})$$
$$\beta = 10 \times 10.91381385\ dB$$
$$\beta = 109.138\ dB$$
$$\beta = 109.14\ dB$$

Hence, intensity level = $\beta = 109.14\ dB$

2. **A ship is anchored where the depth of water is 120m. An ultra-sonic signal sends to the bottom of the lake returns in 0.16s. What is the speed of sound in water?**

Given data:

Depth of water =S=120m

Total time=T=0.16s

Time taken by the sound to reached the bottom of water=t=T/2

$$t = \frac{0.16}{2}\ sec$$
$$t = 0.08\ sec$$

Required:

Speed of sound=v=?

Solution:

We know that

$$S = vt$$
$$\Rightarrow v = \frac{S}{t} - - - (1)$$

Putting values in eq (!1), we get

$$v = \frac{120}{0.08}$$
$$v = 1500 m/sec$$

3. **A gunshot from a .22 rim fire rifle has an intensity of about I= (2.5×10^{13}) Io. Do we need to wear ear protection? (Considering that prolonged exposure to sounds above 85 decibels can cause hearing damage or loss).**

Given data:

Intensity=I=$2.5\times10^{13}\ I_o$

Intensity level limit =85dB

Required:

(a) Intensity level =β =?

(b) Ear protection=?

Solution:

(a) We know that

$$\beta = 10 log\frac{I}{I_o}$$

Putting values

$$\beta = 10 log\left(\frac{2.5 \times 10^{13} I_o}{I_o}\right)$$
$$\beta = 10 log(2.5 \times 10^{13})$$
$$\beta = 10 \times 13.39$$
$$\beta = 133.9\ dB$$
$$\beta = 134\ dB$$

(b) As we have given that safe intensity level limit is 85dB, so 134dB is to greater than 85dB. So we need to wear ear protection.

4. **What sound intensity level in dB is produced by earphones that create an intensity of 4.00 ×10^{-2} W/m^2? (Use the usual reference level of I_o =1.00×10^{-12}W/m^2).**
Given data:
Intensity of sound =I=4.00 ×10^{-2} W/m^2
Usual reference level = I_o =1.00×10^{-12}W/m^2
Required:
Intensity level= β =?
Solution:
We know that

$$\beta = 10log\frac{I}{I_o}$$

Putting values

$$\beta = 10log\left(\frac{4.00\ \times 10^{-2}}{1.00 \times 10^{-12}}\right)$$

$$\beta = 10log(4 \times 10^{10})$$
$$\beta = 10 \times 10.60205999$$
$$\beta = 106.02dB$$

5. **What is the speed of sound in air at -20°C?**
Given data:
Temperature=T= -20°C
Required:
Speed of sound =v=?
Solution:
We know that
$v = 331 + 0.6T - - - -(1)$
Putting T =-20°C in eq (1), we get
$v = [331 + 0.6 \times (-20)]m/s$
$v = [331 - 12]m/s$
$v = 319\ m/s$
Hence, the speed of sound at -20°C is 319 m/s.

6. **Army man wear binoculars see the flash from enemy tank fire 5 sec before the fire is heard, he records 26°C temperature on his personal thermometer. What is the distance of the tank from him?**
Given data:
Time =t=5 sec

Temperature=T=26°C

Required:

Distance of tank =S=?

Solution:

We know that

$$S = vt - - - - (1)$$

Also

$$v = 331 + 0.6T - - - - (2)$$

Putting eq (2) in eq (1), we get

$$S = (331 + 0.6T)t - - - - - (3)$$

Putting values in eq (3), we get

$$S = (331 + 0.6 \times 26) \times 5$$
$$S = (331 + 15.6) \times 5$$
$$S = (346.6) \times 5$$
$$S = 1733m$$
$$S = 1.733 \times 10^3 m$$
$$S = 1.733\ km$$
$$S = 1.7\ km$$

So the distance of tank is 1.7 km.

7. **Calculate the wavelengths of sounds at the extremes of the audible range, 20Hz and 20,000Hz, at normal temperature of 20°C?**

Given data:

Frequency of 1st sound = f_1=20Hz

Frequency of 2nd sound = f_2=20,000Hz

Temperature=T=20°C

Required:

i. Wavelength of 1st sound = λ_1=?
ii. Wavelength of 2nd sound = λ_2=?

Solution:

i. We know that

$$v = f\lambda$$
$$\Rightarrow \lambda = \frac{v}{f}$$
$$\Rightarrow \lambda_1 = \frac{v}{f_1} - - - - (1)$$

Also

$$v = 331 + 0.6T - - - - (2)$$

Putting eq (2) in eq (1), we get

$$\lambda_1 = \frac{331 + 0.6T}{f_1} - - - - (3)$$

Putting values in eq (3), we get

$$\lambda_1 = \frac{331 + 0.6 \times 20}{20}$$
$$\lambda_1 = \frac{331 + 12}{20}$$
$$\lambda_1 = \frac{343}{20}$$
$$\lambda_1 = 17.15m$$

Or

$$\lambda_1 = 17\ m$$

ii. For $\lambda_2$eq (3) becomes

$$\lambda_2 = \frac{331 + 0.6T}{f_2} ----(4)$$

Putting values in eq (4), we get

$$\lambda_1 = \frac{331 + 0.6 \times 20}{20000}$$
$$\lambda_1 = \frac{331 + 12}{20000}$$
$$\lambda_1 = \frac{343}{20000}$$
$$\lambda_1 = 0.017\ m$$

Or

$$\lambda_1 = 0.017 \times 100\ \ cm$$
$$\lambda_1 = 1.7\ cm$$

8. Ishfaq stands between two high rise buildings A and B, such that he is at 33m distance from building A. When he blows the whistle, he hears first echo after 0.2s and second echo after 0.8s. Calculate (a) the Speed of sound and (b) distance of building B from him?

Given Data:

Distance of Ishfaq from building "A" =S_1= 33m

Time for 1st echo=T_1=0.2sec

Time for 2nd echo=T_2 = 0.8sec

Required:

i. Speed of sound =v=?

ii. Distance of building "B" from Ishfaq =S_2=?

Solution:

i. Speed of sound =v=?

Time for 1st echo=T_1=0.2 sec

Time for echo to reach building "A" =t_1=?

$t_1=\frac{T_l}{2}$

$t_1=\frac{0.2}{2}$

= 0.1sec

So

$t_1 = 0.1$ sec

Now the speed of sound is given by

$S_1 = vt_1 \longrightarrow (1)$

$\Rightarrow v = \frac{S_1}{t_1} \longrightarrow (2)$

Put S_1=33m and t_1 = 0.1 sec in eq (2) we get,

$\Rightarrow v = \frac{33}{0.1}$

$\Rightarrow v = 330$m/sec

ii. Distance of building "B" from Ishfaq $=S_2=?$

Time for 2nd echo$=T_2=0.8$ sec

Time to reach building "B" $=t_2=?$

$t_2 = \frac{T_2}{2}$

$t_2 = \frac{0.8}{2}$

$= 0.4$sec

So

$t_2 = 0.4$ sec

Now to find the distance of building "B" from Ishfaq is given by

$S_2 = vt_2 \longrightarrow (3)$

Put given values in eq (3), we get

$S_2 = 330 \times 0.4$

$\Rightarrow S_2 = 132$m

So the distance of Ishfaq from building "B" is 132 m.