SHORT QUESTIONS

11.1 Sound Waves

11.2 Characteristics Of Sound

11.3 Speed Of Sound

Q.1. What is sound wave? How sound is produced?

Sound Wave

A sound wave is a pattern of disturbance caused by the movement of energy traveling through medium as it propagate away from source of sound.

Like other waves sound is also produced by vibrating bodies. Due to vibration of bodies the air around them also vibrates and the air vibration produces sensation of sound in our ear.

Q.2. Ans: What is tuning fork?

Ans: It is a U-shaped body having two metal prongs with a stem at the bottom and is used for producing sound of particular frequency.

Q.3. Why medium is required for the propagation of sound waves?

Ans: Sound waves are compressional waves in nature. That is the type of mechanical waves and we know that mechanical waves require medium for their propagation. So we can say material medium is necessary for the propagation of sound from one point to another. This material medium can be a gas, a liquid or a solid.

Q.4. Define loudness of sound and what are the factors affecting it?

Ans: Definition

"The characteristic of sound by which a loud and faint sound can be distinguished is called loudness of sound".

Factors affecting loudness of Sound

Following are the factors that affect the loudness of sound.

- Amplitude of vibrating body
- Area of vibrating body
- Distance from vibrating body
- Physical condition of ear

Q.5. Define pitch of the sound

Ans: The characteristic of sound by which a shrill sound can be distinguished from a grave one is called the pitch of the sound.

Dependence on Frequency

It depends upon the frequency, the greater the frequency, the higher the pitch and lower the frequency, the lower the pitch.

Q.6. Define the quality of sound with an example.

Ans: "The characteristic of sound by which two sounds of same loudness and pitch are distinguished from each other is called the quality of sound".

Example

Sounds of flute and piano of given loudness and pitch can be distinguished because the quality of their notes is different.

Dependence:

It depends upon the waveform of the sound waves. The loudness and pitch of these two sounds are the same but their waveforms are different. So their quality is different and can be distinguished from each other

Q.7. What is intensity of sound?

Ans:

Intensity of sound

"Sound energy flowing per second through a unit area held perpendicular to the direction of propagation of sound waves is called the intensity of sound"

Unit

The unit of intensity of sound is watt per square meter ($\mathbf{Wm^{-2}}$). Intensity is a physical quantity and can be measured accurately.

Intensities of Faintest and Loudest sound

The intensity of faintest sound is $\mathbf{10^{-12}\ Wm^{-2}}$ and the intensity of the loudest sound, which can be heard without pain, is $\mathbf{1\ Wm^{-2}}$.

Q.8. State Weber Fechner Law

Ans: Weber Fechner Law

It has been proved experimentally that loudness (L) of a sound is directly proportional to the logarithm of intensity.

Mathematically:

$$L \propto \log I$$
$$L = K \log I$$

Where L is loudness of sound, K is proportionality constant and I is intensity of sound.

Q.9. Intensity Level or Sound Level

Ans. The difference between the loudness of any unknown sound and faintest sound ($L - L_0$) is called the intensity level or sound level.

Mathematically:

$$\text{Sound level} = K \log \frac{I}{I_0}$$

Where I is intensity of unknown sound, K is proportionality constant and I_o is intensity of the faintest sound.

Q.10. Define SI unit of sound level (Bel)

Ans. Bel:

If the intensity of any unknown sound is 10 times greater than the intensity I_0 of the faintest audible sound i.e. $I = 10I_0$ then the intensity level of such sound is taken as unit, called Bel. The value of K becomes 1.

Mathematically:

$$\text{Sound Level} = K \log \frac{I}{I_0} \text{ (Bel)}$$

By substituting K = 1, equation becomes

$$\text{Sound Level} = \log \frac{I}{I_0} \text{ (Bel)}$$

Q.11. Find sound level of sound of train?

Ans: Intensity of sound of train is 10^{-2} Wm^{-2} and sound level of faintest sound is 10^{-12} Wm^{-2} then

Sound level of sound of train (in bel) $= \log \frac{10^{-2}}{10^{-12}}$ (Bel)

$= \log 10^{10} = 10$ Bel

Sound level of sound of train in decibel $= 10 \log \frac{10^{-2}}{10^{-12}}$ (dB)

$= \mathbf{10 \log 10^{10} = 100\ dB}$

11.4 Reflection (Echo) Of Sound:

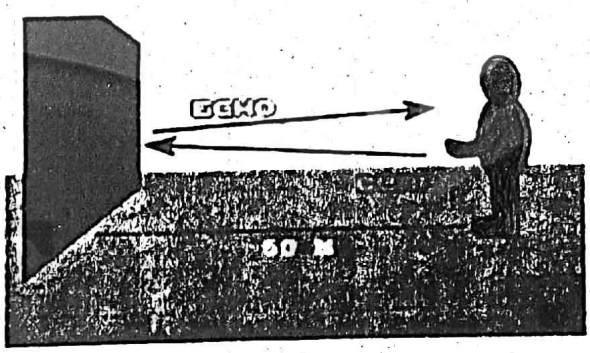
Q.12. How reflection (Echo) of sound can be defined ?

Echo:

"When sound is incident on the surface of a medium it bounces back into the first medium. This phenomenon is called echo or reflection of sound".

Q.13. Calculate minimum distance to hear Echo.

Ans. The sensation of sound persist in our brain for about 0.1s. to hear a clear echo, the time interval between our sound and the reflected sound must be at least 0.1s. If we consider speed of sound to be 340 ms^{-1} at a normal temperature in air, we will hear the echo after 0.1s. The total distance covered by the sound from the point of generation to the reflecting surface and back should be at least 340 ms^{-1} × 0.1 s = 34.0 m. Thus, for hearing distance echoes, the minimum distance of the obstacle from the source of sound must be half of this distance that is 17m. Echoes may be heard more than once due to successive or multiple reflections.



Q.14. Calculate the frequency of a sound wave of speed 340 ms^{-1} and wavelength 0.5m.

Ans.

Solution:

Given that:

Speed of waves $v = 340\ ms^{-1}$

Wave length $\lambda = 0.5$ m

Required

Frequency $= f = ?$

Using the formula $v = f\lambda$

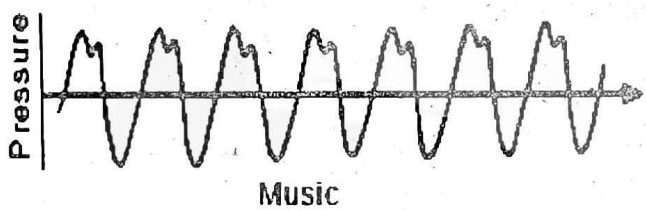
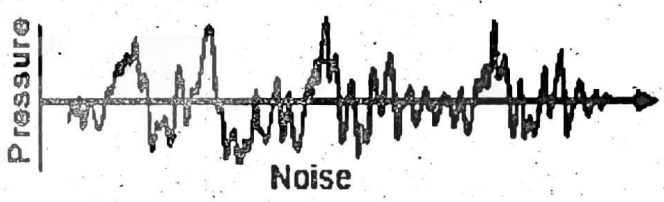
$$f = \frac{v}{\lambda} = \frac{340}{0.5}$$

$$f = 680 Hz$$

11.5 Noise Pollution:

Q.15. What is noise pollution? Explain its sources and effects. How it is reduced? OR Differentiate between music and noise. Explain effects of noise and safe level of noise.

Ans:

Music	Noise
• The sounds that have pleasant effect on our ears are called musical sounds. • The frequency and amplitude of musical sounds change in a regular manner. • Sounds produced by the musical instruments like flute, violin, harmonium are musical sounds. **Examples** • We enjoy the programmes of radio or television by hearing sounds of different qualities. • In musical programmes, we hear sound produced by musical instruments such as flute, harmonium, violin, drum etc. **Waveform:**  Music	• The sounds that have jarring or unpleasant effect on our ears are called noise. • The frequency and amplitude of the noise change in irregular manner. • Sounds of traffic or sound produced by hammering in factories are noise. **Examples** • Sound of machinery • The slamming of a door, • Sounds of traffic in big cities. **Waveform:**  Noise

Q.16. What is meant by Noise Pollution and describe its Sources

Ans. Noise Pollution

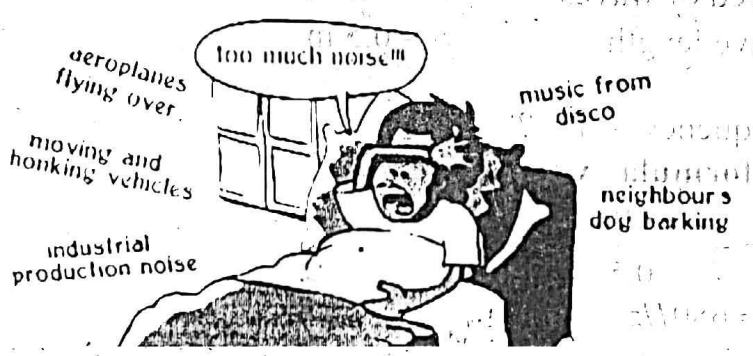
Noise pollution has become a major issue of concern in big cities. Noise is a undesirable sound that is harmful for health of human and other species.

Sources:

The sources of noise pollution are given below

- Transportation equipment
- Heavy machinery

These are the main sources of noise pollution. For example, noise of machinery in industrial areas, loud vehicle horns, hooters and alarms.



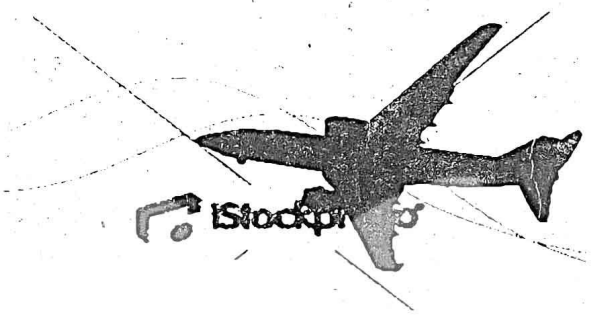
Q.17. What are effects of Noise?

Ans. Effects of Noise:

Noise has negative effects on human health as it can cause conditions such as

- Hearing loss
- Sleep disturbances,
- Aggression,
- Hypertension,
- High stress levels.

Noise can also cause accidents by interfering with communication and warning signals.



Q.18. Enlist any five sound of Music and noise.

Ans. Musical sounds

(i) Sound of harmonium
(ii) Sound of flute
(iii) Sound of tabla
(iv) Sound of songs
(v) Sound of violin

Noises

(i) Sound of traffic
(ii) Sound of moving train
(iii) Sound of aeroplanes
(iv) Sound of crying
(v) Sound of horns

Q.19. What are the major sources of noise in our society?

Ans: Automobiles, aeroplanes, helicopters, trains, heavy machinery, heavy traffic, loud speakers are the major sources of noise pollution in our society.

Q.20. How noise can be reduced?

Ans: Trees and different appliances are used to reduce the noise

Q.21. What do you know by Safe Level of Noise:

Ans. Safe Level of Noise:

A safe level of noise depends on two factors: the level (volume) of the noise; and the period of exposure to the noise. The level of noise recommended in most countries is usually 85-90 dB over an eight hour workday. Noise pollution can be reduced to acceptable level by replacing the noisy machinery with environment friendly machinery and equipments, putting sound-reducing barriers, or using hearing protection devices.

Q.22. Define acoustics protection. Explain importance of acoustic protection.

Ans. Acoustic Protection.

"The technique or method used to absorb undesirable sounds by soft and porous surfaces is called acoustic protection."

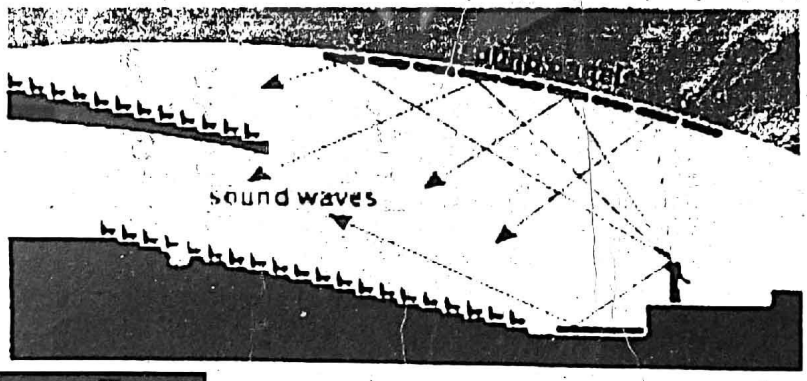
Importance of Acoustic:

Reflection of sound is more prominent if the surface is rigid and smooth and less if the surface is soft and irregular. Soft, porous materials, such as draperies and rugs absorb large amount of sound energy and thus quiet echoes and softening noises. Thus by using such materials in noisy places, we can reduce the level of noise pollution.

Q.23. What is meant by Reverberation:

Ans. When sound reflects from the wall, ceiling and floor of a room, the reflecting surfaces are too reflective and the sound becomes garbled. This is due to multiple reflections called reverberations.

In the design of lecture halls, auditorium or theatre halls, a balance must be achieved between reverberation and absorption. It is often advantageous to place reflective surfaces behind the stage to direct sound to the audience.



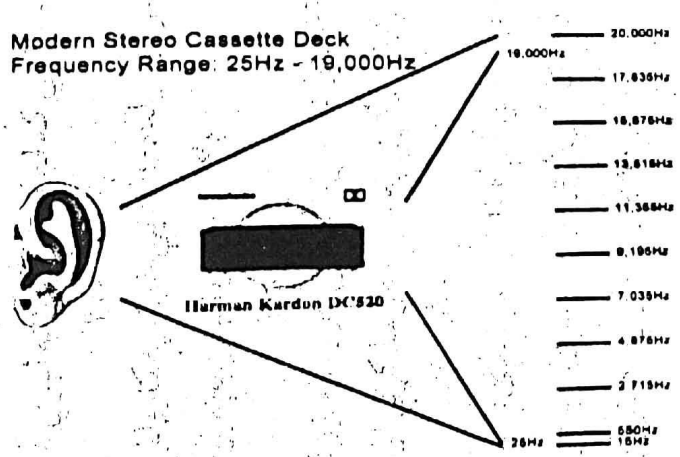
11.6 Audible Frequency Range:

Q.24. What is audible frequency range for human and why we cannot hear if sound ranges more than this range.

Ans: A human ear can hear sound only if its frequency lies between 20 to 20000 Hz. A human ear can neither hear a sound of frequency less than 20 Hz nor a sound of frequency more than 20000 Hz. Sounds of frequency beyond the 20000 Hz are inaudible because the eardrum of human ear cannot vibrate so rapidly. The audible range is different for different persons and it also varies with the age.

Q.25. What is silent whistle and why it is called so?

Ans: Some people use silent whistle to call dogs whose frequency lies between 20,000 Hz to 25,000 Hz and human ear cannot detect it. So, it is silent for human that is why it is called silent but it is not silent for the dogs because their audible range is much more than human.



11.7 Ultrasound:

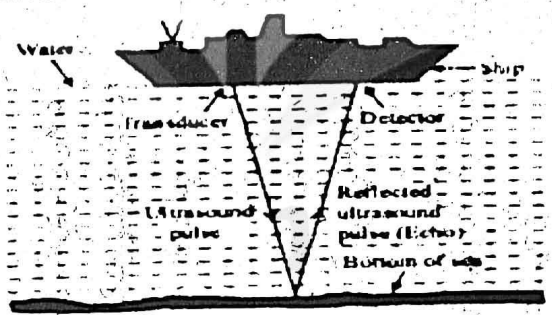
Q.26. What are ultrasonic and why they are used in our life?

Ans: "Sound waves of frequency higher than 20000 Hz are ultrasonics"

It has been seen that ultrasonic waves carry more energy than audible sound waves. Moreover, according to the relation $v = f\lambda$, the wavelength of ultrasonic waves is very small. Due to these characteristics they are usefully utilized in medical and technical fields.

Q.27. How we can find the depth of ocean?

Ans: Ultrasound is used to locate underwater depths or is used for locating objects lying deep on the ocean floor, etc. The technique is called SONAR, (sound navigation and ranging). The sound waves are sent froma transmitter, and a receiver collects the reflected sound. The time lapse is calculated, knowing the speed of sound in water, the distance of the object from the ocean surface can be estimated



Ultrasonic are used to measure depth of water by echo method (fig 1.a)