10th Physics

Chapter 11 Sound

Conceptual Questions

1. Why does Sound travel faster in Solids than liquids and gases?

Sound travel faster in Solids than liquids and gases.

Explanation:

→ Sound is a mechanical wave which travels from one point to another by vibration of particles.

In Solids, particles are very close to each other. When Sound transferred to Solids, particles vibrate and strike next particle and transfer Sound very quickly. While in liquid and gases particles are not very close to each other.

→ Secondly,

$$V = \sqrt{\frac{E}{\rho}}$$

Speed of Sound $\propto$ Ratio of Elasticity to density

For Solids, Elasticity to density ratio is much greater than for liquids and gases.

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2. Why are we able to distinguish between two Sounds having Same loudness?

We are able to distinguish between two Sounds of Same loudness because of their different pitch or quality.

Explanation:

The characteristic of Sound due to which we can distinguish between a Shrill and a grave Sound is called pitch. If a girl and a boy are talking to each other with Same loudness, their voices can easily be distinguish because of different pitch.

Now Consider two boys are talking to each other with Same loudness. In this case pitch of the two boys are Same but still we can distinguish their voices. It is possible due to

a characteristic of **Sound** called quality or timbre.

3. Vibrating mobile phone on wooden table Sounds louder than held in hand. Why?

Vibrating mobile phone on wooden table Sounds louder than held in hand because Surface area of wooden table is greater than Surface area of phone.

Explanation: Loudness of Sound is directly proportional to the Surface area of the vibrating body. When mobile phone is in Contact with the table, the vibration of the mobile phone is transmitted to the Surface of table whose Surface area is very large as Compared to the Surface area of phone and hence Sound becomes louder.

4. During a match in Cricket Stadium, You See a batsman striking the ball but we hear Stroke Sound Slightly later. Explain this time difference?

We hear the Sound of stroke Slightly later than we See the shot because speed of Sound is very much less than speed of light.

Explanation: when we See Something we need light rays and when we hear Something we need Sound waves. As we know that speed of light is much greater than speed of Sound, So we See the Stroke earlier than we hear its Sound because light reaches us earlier than Sound. That's why we hear the Stroke Sound Slightly later.

5. How much intensity level increases when intensity of louder Sound is double the intensity of faintest audible Sound?

The intensity level will increase to 3dB when intensity of louder Sound is double the intensity of faintest audible Sound.

Explanation: From Weber Fechner law

$$\text{Intensity level}(\beta) = 10 \log \frac{I}{I_0} \quad (dB)$$

Here I_0 is the intensity of the faintest audible Sound and I is the intensity of the louder Sound. As it is given that $I = 2I_0$, therefore the above equation becomes;

$$\Delta\beta = 10 \log \frac{2I_0}{I_0} \quad (dB)$$

$$= 10 \log 2 \quad (dB)$$

$$= 10 (0.3010) \quad (dB)$$

$$\boxed{\Delta\beta = 3 \text{ dB}}$$

6. Two Singers are Singing together Simultaneously with intensity level 60dB of each in a hall.

a. Is intensity of Sound in the hall is doubled?

b. Is the intensity level of Sound is doubled?

a. Yes, the intensity of the Sound in the hall will be doubled.

When two Singers are Singing Simultaneously with intensity of 60dB each, their Coresponding intensities will be 1×10^{-6} W/m^2 each. Now the two intensities will be added up to double the intensity, i.e 2×10^{-6} W/m^2.

b. The intensity level of the Sound will be increased three decibels (3dB).

As we know

$$\Delta\beta = 10 \log \frac{I}{I_0} \quad (dB)$$

Here I is the Combined intensity of the two Sounds while I_0 is the reference intensity and is taken as the intensity of the Single Sound.

So

$$\Delta\beta = 10 \log \frac{2 \times 10^{-6}}{1 \times 10^{-6}} \quad (dB)$$

$$= 10 \log \frac{2}{1} \quad (dB)$$

$$= 10 \log 2 \quad (dB)$$

$$= 10 \ (0.3010) \quad (dB)$$

$$= 3 \quad (dB)$$

$$\boxed{\Delta\beta = 3dB}$$

Thus, the intensity of the Sound will increase three decibels.

7. If pitch of Sound is increased then what is its effect on

a. Frequency of Sound
b. Speed of Sound
c. Intensity of Sound
d. Loudness of Sound
e. Wavelength

a. If pitch of Sound is increased, then frequency of the Sound will also increase, as both are directly proportional. Pitch $\propto$ frequency

b. Speed remains same because speed of Sound depends on the medium and not on frequency or pitch.

c. Intensity of Sound will not change by changing pitch of Sound, because intensity of Sound is related to amplitude of the wave, not its frequency.

d. Loudness of Sound is not affected by the pitch of Sound.

e. Wavelength will decrease as $\lambda \propto \frac{1}{f}$

8. Vibrating bodies produce Sound. When a pendulum vibrates, we do not hear its Sound. Why?

Sound produced by Simple pendulum is not heard because of low frequency.

Explanation:

Human ear can hear a Sound of frequency greater than 20 Hz and Smaller than 20,000 Hz. In Case of Simple pendulum, the frequency is always less than 20 Hz due to which we cannot hear its Sound.

9. Two students are talking in the Corridor of your School; you can hear them in your class room but you cannot see them. Why?

Because Sound waves is diffracted more than light waves, that's why we cannot see them but can hear them.

Explanation: The wavelength of light is very short than the wavelength of Sound. The waves with

greater wavelength bend more. So diffraction of Sound is more than diffraction of light.
So, when the two students are talking, their Sounds diffracted along the Corner and reaches to us while the light waves cannot be diffracted along the Corner. Thus, we can hear them but Cannot See them.

10. How do Curtains help to reduce loudness of Sound?

Curtains Can absorb Sound and therefore Can help to reduce loudness of Sound.

Explanation:

Hard Surface like tiles and wood will help travelling of Sound by reflecting the waves whereas Softer materials like Carpet and Curtains help to Stop Sound in its tracks by absorbing the waves.

Noisy and loud Sound enters the home through windows and doors. Curtains act as a guard and absorb exterior loud Sound trying to get inside the home. In this way Curtains helps to reduce loudness of Sound.

10. What steps would you take to stop echoing in a large room?

Reflection of Sound from a hard Surface is called echo.

Some steps in order to stop echoing in a large room:

1. Hang Soft Curtains on the doors and windows. Curtains absorb Sound and do not reflect it.

ii. By Carpeting the floor.

iii. By false Ceiling (making Ceiling irregular).

iv. Add Some furniture to the room so that the Sound doesn't reflect directly.

v. By placing Curtains or foam on the wall of the room.

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