CHAPTER#11 SOUND

CONCEPTUAL QUESTIONS

QUESTION#1

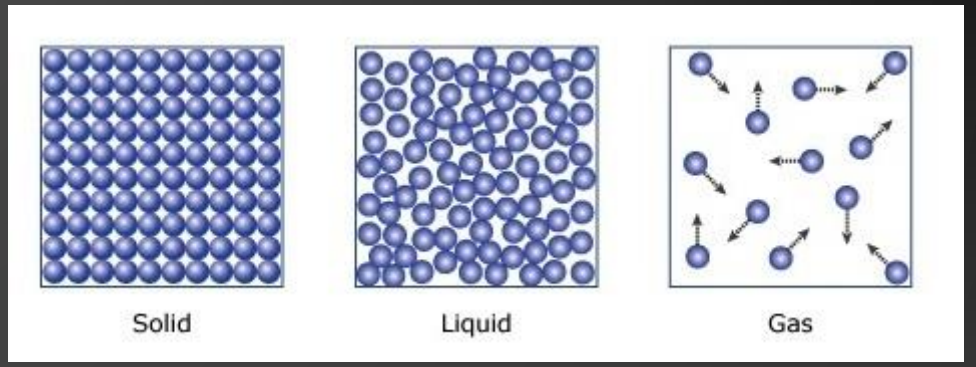
Why does sound travel faster in solids than liquids and gases?

Answer:

Sounds travel faster in solids because:

- Particles in solids are much close together as compared to liquids and gases.
- Elastic modulus of solids is much grater than as compared to liquids and gases.

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



QUESTION#2

Why are we able to distinguish between two sounds having same loudness?

Answer:

We can differentiate between two sounds of same loudness by two ways:-

- Pitch of sound : Shrillness or graveness of sound will help us to differentiate the two different sounds. Pitch depends on frequency.
- Quality of Sound : Nature of sound help us to distinguish different sounds. Quality of sound is a god gifted thing.

QUESTION#3

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

Answer:

Greater the surface area of vibrating body, greater will be the loudness.

- Since vibrating mobile phone on wooden table has greater surface area as compared to that in hand, therefore, phone on table sounds louder.
- Moreover, our hands are porous, so they absorb sound energy of phone, decreasing its loudness.

QUESTION#4

During a match in cricket stadium, you see a batsman striking the ball but why we hear stroke sound slightly later?

Answer:

We see batsman hitting the ball first and hear stroke later because speed of light is much grater than speed of sound in air.

Speed of light in air = 300,000,000 ms^{-1}

Speed of sound in air = 340 ms^{-1}

QUESTION#5

How much intensity level increases when intensity of louder sound is double the intensity of faintest audible sound ?

Answer: Intensity level increases up to 3 dB.

By Weber Fechner's Law:

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

$$I = 2I_o$$

$$\beta = 10 \log\left(\frac{2I_o}{I_o}\right)$$

$$\beta = 10 \log(2)$$

$$\beta = 10\ (0.3010)$$

$$\boxed{\beta = 3.01dB}$$

QUESTION#6

Two singers are singing together simultaneously with intensity level of 60 dB of each in a hall.

a) Is intensity of sound in the hall is doubled ?

Answer:

Yes, intensity of the sound in the hall will be doubled as intensity is measured on linear scale. Since both singers are singing together simultaneously, so intensities will add up to form the net intensity.

$$I_{net} = I_1 + I_2$$

QUESTION#6

Two singers are singing together simultaneously with intensity level of 60 dB of each in a hall.

b) Is intensity level of sound is doubled ?

Answer:

No, intensity level of the sound in the hall will be doubled as intensity level is measured on logarithmic scale and quantities don't add simply on the logarithmic scale. The intensity level will increase only up to 3dB.

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

QUESTION#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

Answer:

a) Frequency will increase as pitch $\propto$ frequency.

b) Speed of sound will remain same as it only depend on medium.

c) Intensity of sound will remain same since intensity depends on amplitude.

d) Loudness of sound will remain same since loudness depends on amplitude.

e) Wavelength will decrease as $f \propto \frac{1}{\lambda}$ (for constant speed)

QUESTION#8

Vibrating body produces sound. When a pendulum vibrates, we don't hear its sound. Why?

Answer:

Human ear is unable to hear the sound whose frequency is less than 20 Hz or greater than 20,000 Hz. A simple pendulum vibrates at vey low frequency that is less than 20 Hz. Even a pendulum of 1 metre length has frequency of only 0.5 Hz, which human ear is unable to hear.

QUESTION#9

Two students are talking in the corridor of your school, you can hear them in your class room but cannot see them. Why ?

Answer:

- Higher the wavelength of a wave, greater will be it diffracted.
- Since wavelength of sound wave is greater than wavelength of light wave, therefore light wave is least diffracted and sound wave is more diffracted from same obstacle.
- This is the reason we can hear the students talking outside class room but we can't see them.

QUESTION#10

How do curtains help to reduce loudness of sound?

Answer:

Curtains dampen the level of noise pollution you hear inside your home. A flat, sturdy wall or window will reflect sound waves, while curtains absorb and disperse energy. This is because curtains are constructed of thick, tightly woven materials that leave fewer avenues for sound energy to escape.

QUESTION#11

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

Answer:

- Cover the floor
- Cover the walls and windows
- Fill rooms with furnishings
- Install acoustic panels