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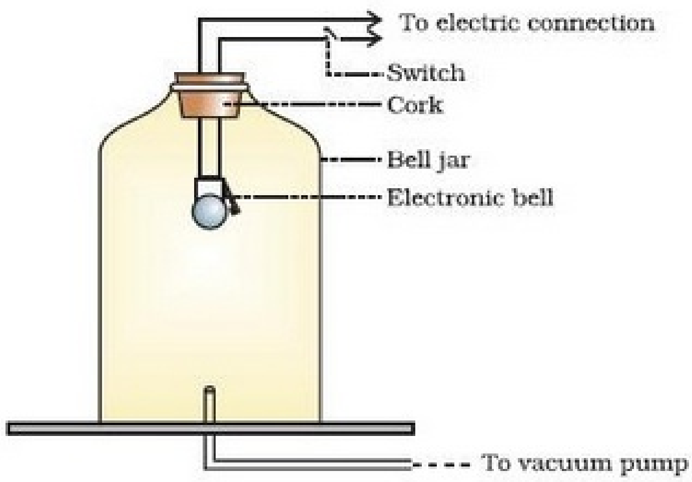
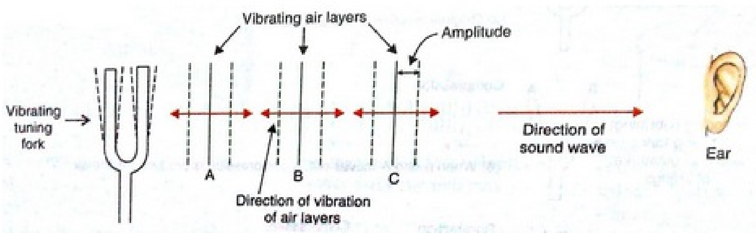
Solution 60
(a) Sound is that form of energy which makes us hear. Sound waves are longitudinal waves in air.
(b) Sound cannot travel through vacuum. This can be shown by the following experiment:
(i) A ringing electric bell is placed inside an air tight glass jar containing air. We can hear the sound of ringing bell clearly. Thus, when air is present as medium in the bell jar, sound can travel through it and reach our ears.
(ii) The bell jar containing ringing bell is placed over the plate of a vacuum pump. Air is gradually removed from the bell jar by switching on the vacuum pump. As more and more air is removed from the bell jar, the sound of ringing bell becomes fainter and fainter. And when all the air is removed from the bell jar, no sound can be heard at all. Thus, when vacuum is created in the bell jar, then the sound of ringing bell placed inside it cannot be heard. This shows that sound cannot travel through vacuum.



Solution 61
(a) Sound is produced when an object vibrates. For example, the sound of our voice is produced by the vibrations of two vocal cords in our throat caused by air coming from the lungs.
(b) When an object vibrates (and makes sound), then the air layers around it also start vibrating in exactly the same way and carry sound waves from the sound producing object to our ears. Suppose a tuning fork is vibrating and producing sound waves in air. Since the prongs of the tuning fork are vibrating, the individual layers of air are also vibrating. Sound travels in the form of longitudinal waves in which the back and forth vibrations of the air layers are in the same direction as the movement of sound wave.



Solution 62
(a) If the air is gradually pumped out of the glass vessel, no sound of the electric bell can be heard because vacuum is created in the vessel and there are no air molecules to carry sound vibrations.
(b) Sound cannot be heard on the surface of moon because there is no air on the moon to carry the sound waves.
Astronauts talk to one another on the surface of moon through wireless sets using radio waves. This is because radio waves can travel even through vacuum though sound waves cannot travel through vacuum.
Solution 63
(a) The number of vibrations per second is called frequency.
The minimum distance in which a sound wave repeats itself is called its wavelength.
The distance travelled by a wave in one second is called velocity of wave.
Relation between velocity, frequency and wavelength of a wave:
Velocity of wave= frequency x wavelength

Velocity of wave= frequency x wavelength

$$v = f \times \lambda$$

(b) Time period, T=1/256 s

Velocity, V = 350m/s

$$\text{Frequency} = \frac{1}{\text{time period}} = 256\ \text{Hz}$$

Hence,

$$\lambda = \frac{\text{Velocity of wave}}{\text{Frequency}}$$

$$= \frac{350}{256} = 1.36\ \text{m}$$

Solution 64
(a) A wave in which the particles of the medium vibrate back and forth in the 'same direction', in which the wave is moving, is called a longitudinal wave. These waves can be produced in all the three media: solids, liquids and gases.

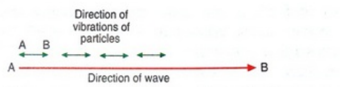


Diagram to explain the meaning of a longitudinal wave.

A wave in which the particles of the medium vibrate up and down 'at right angles' to the direction in which the wave is moving, is called a transverse wave. It can be produced in solids and liquids but not in gases.

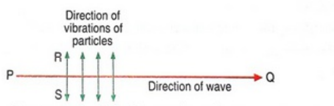


Diagram to explain the meaning of a transverse wave.

(b) Longitudinal waves:
(i) The waves which travel along a spring when it is pushed and pulled at one end.
(ii) Sound waves in air Transverse waves:
(i) The waves produced by moving one end of a long spring up and down rapidly, while other end is fixed.

(ii) The water waves or ripples formed on the surface of water in a pond.
Solution 65
(a) A compression is that part of a longitudinal wave in which the particles of the medium are closer to one another than they normally are, and there is a momentary reduction in volume of the medium.
A rarefaction is that part of a longitudinal wave in which the particles of the medium are farther apart than normal, and there is a momentary increase in the volume of the medium.
Longitudinal waves consist of compressions and rarefactions.

(b) Speed = $\frac{\text{Distance}}{\text{time}}$

Speed = 330 m/s
Distance = 1.32 km = 1320 m

$$\text{Time} = \frac{\text{distance}}{\text{speed}} = \frac{1320}{330} = 4\text{sec}$$

Solution 66
(a) The 'elevation' or 'hump' in a transverse wave is called crest. It is that part of the transverse wave which is above the line of zero disturbance of the medium. The 'depression' or 'hollow' in a transverse wave is called trough. It is that part of the transverse wave which is below the line of zero disturbance of medium. A ransverse wave consists of crests and troughs.
(b) Speed of sound= 332m/s
Time =3 sec

A transverse wave consists of crests and troughs.
(b) Speed of sound= 332m/s
Time =3 sec

Speed = $\frac{\text{Distance}}{\text{time}}$

Distance = Speed x Time
= 332 x 3= 996 m

Solution 67
(a) When we put our ear to a railway line, we can hear the sound of an approaching train even when the train is far off but its sound cannot be heard through the air. This is due to the fact that sound travels much more fast through the railway line made of steel than through air.
(b) There is no actual movement of air from the sound-producing body to our ear. The air layers only vibrate back and forth, and transfer the sound energy from one layer to the next layer till it reaches our ear.
This will be clear from an example: If we turn on a gas tap for a few seconds, a person standing a few metres away will hear the sound of escaping gas first and the smell of gas reaches him afterwards. The sound of gas travels through the vibrations of air layers so it reaches first, but the smell of gas reaches the person through the actual movement of the air layers, which takes more time. So, it is clear that the sound is not being transmitted by the actual movement of air from the gas tap to person, otherwise he would hear and smell the gas at the same time.

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