

Answers to Exercises

- A.
- The three characteristics that help us distinguish between one sound and another are a sound's loudness, pitch and quality.
 - The loudness of a sound depends on the amplitude of the vibrations that produce it.
 - The pitch of a sound has to do with how shrill or bass it is. The pitch of a sound depends on the rapidity of its vibrations.
 - When we increase the tautness of a stretched string, the string vibrates faster and produces a shriller sound.
 - The tautness of the membrane and its area in percussion instruments determine the pitch of the sound produced. Smaller areas and tauter membranes produce shriller sounds.
 - When we strike a glass as we increase the level of water in it, the pitch of the sound produced by it changes.
 - Infrasonics are sounds of a frequency below 20 Hz.
 - Porpoises and bats are two animals that can hear sounds we cannot hear.
 - Bats use echoes to locate their prey. They emit ultrasonic vibrations and can judge the distance of the prey from the time taken by the echo to return.
- B.
- The loudest, basic sound produced by a musical instrument is called the fundamental. The other sounds mixed with it, called harmonics, are softer and of varying loudness. When the same note is played on different instruments, the fundamental is the same. However the harmonics are different. Generally, the quality of a sound is better if more harmonics are present.
 - Music is produced by regular vibrations, or vibrations whose frequencies have a definite relation with each other. Noise is produced by irregular vibrations.
 - The loudness of noise determines how much it can harm our health. Noise can cause stress, anxiety, sleep disturbance and permanent damage to hearing. Very loud noise, like that produced when a jet plane takes off, can burst the ear drum. The noise level in a rock concert can hurt the ears.
 - Light travels faster than sound. So we see a flash of lightning before hearing the peal of thunder. The louder the sound or the greater the amplitude of the vibrations, the greater is the distance travelled by them before they die out.
 - The larynx helps us speak. When exhaled air passes through the larynx, the vocal cords vibrate, producing sound. The vocal cords also control the size of the opening of the larynx. When the vocal cords become taut and thin, and the opening of the larynx becomes narrow, the frequency of the sound produced increases.
 - Echoes are reflected sounds. We can distinguish between two sounds only if there is a time lapse of $\frac{1}{15}$ s between them. Since the speed of sound is 340 m/s, it travels 22.6 m (approximately) in $\frac{1}{15}$ s. This means the reflecting surface must be at least $22\frac{1}{2}$ m, or 11.3 m, away from us to distinguish between the echo and the original sound.
 - Doctors use echoes to get a 'picture' of internal organs of the body. Ultrasonic vibrations reflected by different parts of an organ help to create an image of the organ. The technique is called echocardiography in the case of the heart. The term ultrasonography is generally used in the case of other organs.
- C.
- The sound produced by a vibrating body is a form of energy. The vibrating body transfers this energy to the surrounding air molecules, which then start vibrating with the same frequency. These molecules pass on the vibrations to the neighbouring molecules, and so on. This is how sound travels in all directions from the sound-producing body.
Sound travels much faster through solids than through air because molecules are packed much more closely in solids. Since molecules carry the vibrations, they do so more efficiently when they are closer together.
 - The vibrations of any sound-producing body are transmitted to our ears by the vibrating molecules of air. They first reach the outer ear, which consists of the pinna and the ear canal. When this happens, the air molecules inside the canal start vibrating and strike the eardrum.
The eardrum separates the outer ear from the middle ear, which has three delicate, interlocked bones called the hammer, anvil and stirrup. The vibrations of the eardrum make these bones vibrate. The bones pass on the vibrations to the inner ear, which has a coiled tube called the cochlea. Tiny hairs inside the cochlea pick up the vibrations transmitted from the middle ear. They send a signal to the brain via the auditory nerve, and the brain interprets it to make us hear sounds.
- D.
1. hertz (Hz) 2. amplitude 3. more 4. energy 5. medium
 6. proper maintenance of machines 7. 11.3 m
- E.
1. (c) 2. (c) 3. (d) 4. (a) 5. (b) 6. (b)