C.1. Sound is produced by rapid to-and-fro movements called vibrations.

1. Low frequency sounds below 20 hertz which we cannot hear are called infrasonics, whereas high frequency sounds above 20,000 hertz which also cannot be heard by us are called ultrasonics.
2. The time taken for one complete vibration or oscillation is called its time period.
3. The maximum distance to which an oscillating or vibrating object moves from its central position is called amplitude. The loudness of sound depends on the amplitude of vibration.
4. Sound is produced by rapid to-and-fro movements, called vibrations or oscillations. The number of oscillations per second is called frequency of oscillating body. The SI unit of frequency is hertz (Hz). The higher the frequency, the more shrill is the sound.
5. Women have shorter vocal cords (about

15 mm long) than men (about 20 mm long). Thus, the frequency of women’s voice is higher than that of men and their voice is found to be shrill.

D 1. If we strike a drum softly, it produces a soft sound. If you strike it hard, its skin vibrates with greater amplitude and a louder sound is produced. This shows that loudness of the sound produced by a vibrating object depends on the amplitude of vibration. Loudness is proportional to the square of the amplitude. Thus, if the amplitude is increased by three times, the loudness increases by nine times.

1. We know that sound takes about 3 seconds to travel 1 km. Thus, assuming light covers the distance instantly, the distance of the clouds from Ramesh is 1 km.
2. To hear the echo we need to stand at least 17 m away from the object. This is because, distance travelled by sound in 1/10 second = speed × time = 340 m/s × (1/10) s = 34 m. Thus, we cannot hear the echo if you stand10 m away from a wall and shout towards it.

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1. Humans produce sound in the larynx due to vibrations in the vocal cords. Vocal cords are folds of tissues with a slit-like opening between them. When we speak, air passes through the opening and the vocal cords vibrate to produce sound.
2. There are three types of musical instruments. They are:
	1. Stringed instruments: *Sitar*, guitar, violin, *sarod*, etc., are stringed instruments. They use vibrations in metal wires to produce sound. The frequency of sound is varied by varying the length of the vibrating wire.
	2. Wind instruments: Flute, *shehnai*, etc., are wind instruments. They use vibrations in air columns to produce sound.
	3. Percussion instruments: Drum, *tabla*, *mridangam*, etc., are percussion instruments. They have a stretched skin whose vibrations produce sound. Loudness is increased by striking the skin harder. The pitch is increased by stretching the skin more.
3. Irregular vibrations produce noise. Too much noise in our surroundings is harmful to us and is referred to as noise pollution. Traffic on

the road, machines in factories, mixers and grinders, vacuum cleaners, air coolers, etc., cause noise pollution. In fact, even loud music causes noise pollution.

Two main reasons for noise pollution are:

1. Road traffic
2. Noise from industries
3. Noise can affect human health and well-being in a number of ways.
4. Exposure to sudden high noise level (e.g. explosion) can cause permanent hearing loss due to rupture of eardrum.
5. Prolonged exposure to noise with a volume more than 70 decibels can cause gradual hearing loss, and can even lead to permanent hearing loss.
6. High noise levels can also lead to nervous tension and increase of blood pressure.
7. People experiencing high noise levels experience sleep deprivation and increased number of headaches, and therefore

show increased reliance on sedatives and sleeping pills.

1. Three methods of controlling noise pollution are:
2. Planning land use to reduce noise; for example, making tree-lined buffer zones between residential colonies and roads with heavy traffic.
3. Reducing noise emissions by developing low-noise products, for example, better silencers for automobiles.
4. Measures such as screens and enclosures around machinery to obstruct the path of noise. This will help people working in and living near factories.
5. 1. If the vibrating strings of a *sitar* and a guitar are adjusted to give the same pitch and loudness, we can still distinguish their sound from one another. This is due to another characteristic

of sound known as its quality. It is due to the fact that most vibrating objects simultaneously generate sounds of other frequencies. The quality of a sound is determined by frequencies present in it and their relative loudness.

1. A vibrating object causes air molecules to vibrate. When these vibrations reach our ear, they are collected by the pinna and funnelled into the eartube. These then strike the eardrum, which starts vibrating with the same frequency. This causes the delicate bones of the middle ear to vibrate. This stimulates tiny hairs in the hearing organ which, in turn, send a signal to the auditory nerve of our nervous system. The auditory nerve takes the signal to the brain and we can then hear the sound.
2. Experiment to show that sound can travel through liquids: Let us take a tub filled with water. Hold a bell in one hand and dip it in water. Keep one of your ears (caution: water should not enter your ear) gently on the surface of water and ring the bell inside the water. We will be able to hear the sound clearly. This shows that sound can travel through liquids also.
3. Experiment to show that sound cannot travel through vaccum: Let us take a container with a tight closing lid. Make a hole at the bottom of the container. Connect a vacuum pump to

this hole with a rubber tube. The vacuum pump is used to extract air from the container. Put a cellphone inside the container and close it with the lid. Call the number of the cellphone so that it rings. We can hear the sound clearly. Now, start the vacuum pump and extract the air from the container. Call the number of the cellphone again. We cannot hear the sound now. This experiment proves that sound cannot travel through vacuum.