1. (a) Experiment to prove that sound travels faster in solids than in liquids. Take a squeky toy and put it inside a plastic bag. Seal the bag with the help of a candle or with a thread. Fill a bucket with water and place the bag in the water squeeze the toy. You will hear a low sound. Now place your ear against the side of the bucket and squeeze the toy again. You will hear the sound better.

   From the above experiment we conclude that sound travels through a solid medium faster than in liquid medium.

   (b) Experiment to prove that sound travels faster in solids than in gaseous medium. Palce a wristwatch at one end of a long wooden table stand at the other end of the table. Try to hear the ticking of the watch. Place your ear on the table and listen. You will observe that the ticking of the watch sound is louder when heard through wood. From the above experiment we conclude that sound travels through a solid medium faster than through a gaseous medium.
2. When a stretched string is plucked lightly it vibrates and produces a soft sound. If we pluck it strongly it vibrates with a greater amplitude and a louder sound is produced.
3. Musical instruments : Music is a sound which has pleasant sensation on our ears. A musical sound is produced by regular vibrations and the instruments used to produce music are called musical instruments.

   Depending upon the way the air vibrates they are of four main types:

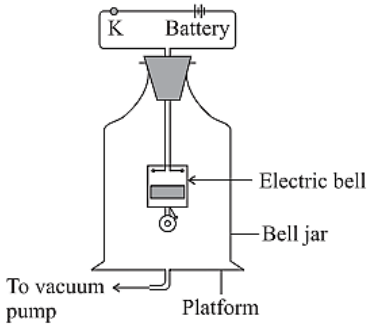
   (i) Stringed musical instruments
   (ii) Percussion instruments
   (iii) Wind instruments
   (iv) Reed instruments
4. Wind instruments are generally made in the form of pipes. When we blow air into them the column of air inside vibrates and produce a note. Whistle, flute and shehnai are some common wind instruments.
5. Stringed instruments have taut strings mounted over specially designed wooden frames. When the strings are plucked or struck or played with bow they vibrate to produce a musical sound of some particular frequency. The pitch of the sound of a musical instrument can be

changed by altering its length. Guitar, sitar and violin are examples of stringed musical instruments.

6. Steps to prevent noise pollution are as follows :
   (i) Automobiles should be fitted with silencers and soft horns.
   (ii) We should not play radio, television and stereo system too loudly.
   (iii) The horns of motor vehicles should not be blown unnecessarily.
   (iv) Ear plugs shold be used by bus or train drivers, mechanics, workers in a factory, etc.
   (v) Airports and noise-making factories should be shifted away from the residential areas of the city.
7. To prove that sound cannot travel in vacuum. We can perform a simple experiment to demonstrate this fact.

   Experiment

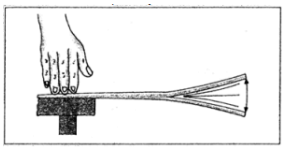
   Connect the bell to the battery so that it starts ringing. Arrange the bell jar around the bell and connect it to a vacuum pump. Start the vacuum pump so that it starts evacuating air from the bell jar. Keep on observing the sound of the ringing bell all the time. We observe that



   we keep on hearing the sound of the bell after the bell jar is kept over it. As the air inside the bell jar is slowly evacuated, the sound becomes dimmer and dimmer and after sometime we cannot hear it at all. We can however still see the bell vibrating as before. We conclude that the sound of the bell reaches us through the air in the bell jar. When the vacuum pump removes the air from the bell jar, the sound does not reach us even though the bell is still vibrating. It follows that sound cannot travel through vacuum.
8. Vibration is a necessary condition for a body to produce sound.

   Experiment

   Take a metallic ruler and press its one end on a table with the left hand and pull down the free end of the ruler with the right



   hand and let it go, what do we observe? The metallic ruler is seen vibrating and a humming sound is heard. The humming sound is produced by the to-and-fro motion of the metallic ruler; the vibrations produced by the vibrating body.

9. (a) Sound is an energy which can be produced by the vibrations in a material body.
   (b) Pleasant sound : Sound produced by musical instruments like sitar, flute, tabla, etc.
   Unpleasant sound : Sound produced by various machines, the bark of a dog, the sound of a supersonic aircraft etc.
   (c) There are two vocal cords in our voice box. Voice box is situated in our throat.
   (d) A narrow slit between the vocal cords makes our vocal cord vibrate.
   (e) Bees have no voice boxes. They make sound by moving their wings up and down very fast.
10. The Human Ear : A vibrating body produces sound that needs a medium (solid, liquid or gas) for its propagation. The medium is usually air. When the sound propagating through air reaches our ears we are able to hear it.
   Our ears are made up of three parts :
   (i) The outer ear,
   (ii) The middle ear, and
   (iii) The inner ear.
   Now as we know, sounds produced make air vibrate. These vibrations in the air make our ear drum vibrate when they strike against it. This in turn makes some tiny delicate bones in our middle ear vibrate with the same frequency, as the source of sound. The vibrations of these tiny bones are passed on to a liquid present in our inner ear. Here there are several nerves which send the message to our brain. When these messages reach our brain we are able to hear and recognise the sound.
11. (a) Ultrasonic vibrations : The vibrations whose frequencies are greater than 20,000 Hz are called ultrasonic vibrations.
   (b) Uses of ultrasonic vibrations.
      (i) Ultrasonic vibrations are used in SONAR to measure the depth of sea (or ocean) and to locate under water objects like submarines, sea-rocks and shipwrecks.
      (ii) It is used for scanning and imaging the position and growth of a foetus and presence of stones in the gall bladder and kidney.
      (iii) It is used for homogenising milk in milk plants where fresh
12. (a) Echo : The repetition of the sound which is reflected from a high building or any such object is called an echo.
   (b) Conditions necessary for hearing an echo.

(i) There should be a high rise building or hill or wall or well.

(ii) Minimum distance between source of sound and reflecting body should be 17 metre.

13. (a) Loudness of sound is measured in decibels (dB). A sound of about 50 to 80 decibels is considered as audible sound.

(b) Unwanted, unpleasant and very loud sounds are called noise. The running of automobiles, loudspeakers and music systems cause noise pollution.

(c) Ways of minimising noise pollution.

(i) Home

(A) Television, radio and power music system should be played at low volume.

(B) Electric generator should be provided with improved and modified silencers.

(ii) Surrounding

(A) Exploding crackers on various functions should be avoided.

(B) Loudspeakers used in marriages and religious places should be played at low volume.

(iii) Automobile

(A) Horns should not be blown unnecessarily.

(B) Automobiles should be provided with improved and modified silencers.

(d) Harmful effects of noise pollution in factories

(i) Noise in the surroundings interfaces with speech and talk with another person.

(ii) A long exposure to noise pollution may result in the loss of hearing to deafness.

(iii) Noise pollution reduces concentration and results in the loss of work efficiency.

(iv) Noise produces headaches, irritability and nervous tension.

14. (i) Infrasonic vibrations : The vibrations whose frequencies are less than 20 Hz are called infrasonic vibrations. Human ear cannot hear these vibrations.

(ii) Audible vibrations : The vibrations whose frequencies are from 20 Hz to 20,000 Hz constitute the audible vibrations. Human ear can hear only these vibrations.

15. Flash of lightning seen first but thunder is heard sometime later this is because, light travels at a very high speed of 3×10^8 m/s whereas the sound travels in air at 330 m/s. Thus, whenever lightning takes place it is seen at once whereas sound will take some time to reach us.

16. When a tuning fork is put into vibrations, its prongs move alternatively inwards and outwards between the positions A and B. As it moves from A to B it compresses the layer of air in front of it. This layer because of elasticity, tries to regain its original size. For this it has to expand. When it does that, it compresses the next layer and so on. This in turn, compresses the next layer and the process is repeated. The compression therefore advances to the right from layer to layer.

    Now consider the instant when the prong moves from B to A. As it moves this way it creates a partial vacuum behind it so that the layer of air in contact with it expands. We call this a rarefaction. Again because of elasticity, it tries to regain its original size, it therefore creates a partial vacuum behind it. The expansion of one layer thus allows the next layer to expand and so on. In this way a rarefaction moves to the right. When the prong vibrates, the compressions and rarefactions follow each other and we have the longitudinal waves travelling through air. Other vibrating bodies, like a ringing bell also produce similar compressions and rarefactions in air before their sound reaches us.